VOL. 3 NO. 9
May 15, 1978

# Energy Research Abstracts

ABSTRACTS 20840-22697

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

# REPORT COLLECTIONS IN THE UNITED STATES

The libraries listed below purchase and maintain microfiche collections of DOE and foreign reports that are abstracted in *ERA*. Most of these libraries have microfiche reader-printers or other photocopy facilities with which to reproduce enlarged copies from microfiche. Charges for reproduction services vary.

**ALABAMA**
Auburn, Auburn University
Tuskegee Institute, Tuskegee Institute
**ARIZONA**
Tucson, University of Arizona
**CALIFORNIA**
Davis, University of California
Los Angeles, University of California
Santa Barbara, University of California
**COLORADO**
Boulder, University of Colorado
**DISTRICT OF COLUMBIA**
Washington, Library of Congress
**FLORIDA**
Gainesville, University of Florida
**GEORGIA**
Atlanta, Georgia Institute of Technology
**HAWAII**
Honolulu, University of Hawaii
**IDAHO**
Pocatello, Idaho State University
**ILLINOIS**
Urbana, University of Illinois
**INDIANA**
Lafayette, Purdue University
**IOWA**
Ames, Iowa State University
**KANSAS**
Manhattan, Kansas State University
**KENTUCKY**
Lexington, University of Kentucky
**MARYLAND**
Baltimore, Johns Hopkins University
College Park, University of Maryland
**MASSACHUSETTS**
Cambridge, Massachusetts Institute of Technology
Worcester, Worcester Polytechnic Institute
**MICHIGAN**
Ann Arbor, University of Michigan
**MISSISSIPPI**
State College, Mississippi State University
**MISSOURI**
Columbia, University of Missouri
Kansas City, Linda Hall Library
**NEW JERSEY**
Princeton, Princeton University
**NEW MEXICO**
Albuquerque, University of New Mexico
**NEW YORK**
Albany, New York State Library
Albany, State University at Albany
Ithaca, Cornell University
New York, Columbia University
Rochester, University of Rochester
Syracuse, Syracuse University
**NORTH CAROLINA**
Raleigh, North Carolina State University
**OHIO**
Cincinnati, University of Cincinnati
Cleveland, Cleveland Public Library
Toledo, University of Toledo
**OKLAHOMA**
Norman, University of Oklahoma
**PENNSYLVANIA**
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University
**PUERTO RICO**
San Juan, University of Puerto Rico
**SOUTH CAROLINA**
Columbia, University of South Carolina
**TEXAS**
Austin, University of Texas
College Station, Texas A & M University
Houston, Rice University
**UTAH**
Salt Lake City, University of Utah
**VIRGINIA**
Charlottesville, University of Virginia
**WASHINGTON**
Pullman, Washington State University
Seattle, University of Washington
**WEST VIRGINIA**
Morgantown, West Virginia University
**WISCONSIN**
Madison, University of Wisconsin

DOE reports so indicated in *Energy Research Abstracts* are offered for sale by National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.

Volume 3, Number 9, May 15, 1978

# ENERGY RESEARCH ABSTRACTS

Published by the **Technical Information Center, Oak Ridge, Tennessee**
**United States Department of Energy**

*Energy Research Abstracts (ERA)* provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors.

Subject matter includes the entirety of DOE's research, development, demonstration and technological programs resulting from its broad charter for energy systems, conservation, safety, environmental protection, physical research and biology and medicine. *ERA* also covers other U. S. Government sponsored energy information and the international literature on reactor technology, waste processing and storage, and fusion technology. In addition, nonnuclear information obtained from foreign governments under agreements for cooperation is covered.

*ERA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Federal, state, and municipal agencies concerned with energy development, conservation and usage may obtain *ERA* free of charge. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

*ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual index will also be available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

# INDEXES TO ERA

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and multivolume basis.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

## Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

**16557** (BAW—10108A) **Qualification of submerged-arc narrow strip cladding process.** Ayres, P.S.; Gottschling, J.D.; Jeffers, G.K. **(Babcock and Wilcox Co., Lynchburg, Va. (USA).** Nuclear Power Generation Div.). Mar 1976. 48p. Babcock and Wilcox, Lynchburg, VA.

(BAW—10074A(Rev.1))
**Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.**
Qualification of submerged-arc narrow strip cladding process, 1:16557 (BAW—10108A)

## Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**Ackermann, A.,** Excitation functions of the (n,2n) reactions of $^{12}C$ and $^{238}U$, 1:18034
**Ackley, M.H.,** *See* Derr, V.E., 1:17257
**Acton, J.P.,** *See* Mitchell, B.M., 1:16369
**Adam, J.C.,** *See* Gitomer, S.J., 1:18301
**Adams, A.A.,** *See* Barger, H.J. Jr., 1:16409
**Adams, M.S.,** *See* Titus, J., 1:17363

## Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

**DIET/RADIOSENSITIVITY EFFECTS**
Influence of various diets on the radiosensitivity of guinea pigs, 1:17675 (ERDA-tr-110)
**DIETHYLENETRIAMINEPENTAACETIC ACID**
*See DTPA*
**DIFFERENTIAL EQUATIONS**
*See also KORTEWEG-DE VRIES EQUATION*
*SCHROEDINGER EQUATION*
**DIFFERENTIAL EQUATIONS/ANALYTICAL SOLUTION**
Singular solution of the capillary equation. I. Existence, 1:18384
Singular solution of the capillary equations. II. Uniqueness, 1:18385

## Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

| | | |
|---|---|---|
| **UAH-RR-** | | |
| 177 | 1:16941 | *See* AD-A-015587 |
| **UARL-R-** | | |
| 911848-44 | 1:16724 | *See* AD-A-009360 |
| 921513-10 | 1:16918 | *See* AD-A-009101 |
| **UCID-** | | |
| 15644-75-4 | 1:16849 | Dep. NTIS, $5.45 |
| 16630-3 | 1:15904 | Dep. NTIS, $4.00 |
| 16949-75-4 | 1:16864 | Dep. NTIS, $5.45 |
| 16984 | 1:15493 | Dep. NTIS, $4.00 |
| 17028 | 1:18336 | Dep. NTIS, $3.50 |
| 17033 | 1:16592 | Dep. NTIS, $3.50 |
| 17038(Rev.1) | 1:18323 | Dep. NTIS, $5.45 |
| 17044 | 1:15429 | Dep. NTIS, $4.00 |
| 17048 | 1:17198 | Dep. NTIS, $5.45 |
| 17061 | 1:18357 | Dep. NTIS, $4.00 |
| 17067 | 1:17240 | Dep. NTIS, $4.00 |
| 17076 | 1:18358 | Dep. NTIS, $3.50 |
| 17086 | 1:15909 | Dep. NTIS, $5.45 |
| 17093 | 1:18287 | Dep. NTIS, $3.50 |
| 17096 | 1:18214 | Dep. NTIS, $3.50 |
| 17097 | 1:17997 | Dep. NTIS, $4.00 |
| 52000-76-2 | 1:18349 | Dep. NTIS, $4.00 |

# AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all DOE reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Information on the availability of the published literature and unpublished conference papers abstracted in *ERA* can be obtained from the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

# CONTENTS


| Category | Page |
|---|---|
| COAL AND COAL PRODUCTS | 2143 |
| PROCESSING | 2143 |
| *CARBONIZATION* | 2143 |
| *DESULFURIZATION AND PURIFICATION* | 2143 |
| *HYDROGENATION* | 2143 |
| *GASIFICATION* | 2144 |
| *LIQUEFACTION* | 2146 |
| *SOLVENT EXTRACTION* | 2148 |
| BY-PRODUCTS | 2148 |
| PROPERTIES | 2148 |
| WASTE MANAGEMENT | 2149 |
| ENVIRONMENTAL ASPECTS | 2150 |
| RESERVES AND EXPLORATION | 2151 |
| MINING | 2151 |
| TRANSPORT AND HANDLING | 2151 |
| COMBUSTION | 2152 |
| MARKETING AND ECONOMICS | 2153 |
| HEALTH AND SAFETY | 2153 |
| REGULATIONS | 2153 |
| PETROLEUM | 2153 |
| GEOLOGY AND EXPLORATION | 2153 |
| DRILLING AND PRODUCTION | 2155 |
| PROCESSING | 2158 |
| PRODUCTS AND BY-PRODUCTS | 2159 |
| MARKETING AND ECONOMICS | 2160 |
| WASTE MANAGEMENT | 2160 |
| ENVIRONMENTAL ASPECTS | 2162 |
| POLICY, LEGISLATION, AND REGULATION | 2164 |
| TRANSPORT, PIPELINES, AND HANDLING | 2164 |
| PROPERTIES | 2164 |
| STORAGE | 2166 |
| COMBUSTION | 2166 |
| NATURAL GAS | 2166 |
| RESERVES | 2167 |
| GEOLOGY AND EXPLORATION | 2167 |
| DRILLING, PRODUCTION, AND PROCESSING | 2167 |
| PRODUCTS AND BY-PRODUCTS | 2169 |
| HEALTH AND SAFETY | 2169 |
| MARKETING AND ECONOMICS | 2169 |
| WASTE MANAGEMENT | 2169 |
| POLICY, LEGISLATION, AND REGULATION | 2169 |
| TRANSPORT, PIPELINES, AND HANDLING | 2169 |
| PROPERTIES | 2170 |
| STORAGE | 2170 |
| OIL SHALES AND TAR SANDS | 2170 |
| RESERVES AND EXPLORATION | 2170 |
| SITE GEOLOGY AND HYDROLOGY | 2171 |
| *SITE GEOLOGY* | 2171 |
| DRILLING, FRACTURING, AND MINING | 2171 |
| OIL PRODUCTION, RECOVERY, AND REFINING | 2171 |
| *IN SITU METHODS, TRUE AND MODIFIED* | 2171 |
| *SURFACE METHODS* | 2171 |
| PROPERTIES AND COMPOSITION | 2171 |
| WASTE RESEARCH AND MANAGEMENT | 2171 |
| ENVIROMENTAL ASPECTS | 2171 |
| NUCLEAR FUELS | 2172 |
| RESERVES | 2172 |
| EXPLORATION | 2172 |
| MINING | 2174 |
| FEED PROCESSING | 2174 |
| ENRICHMENT | 2175 |
| *LASER EXCITATION* | 2175 |
| FUELS PRODUCTION AND PROPERTIES | 2175 |
| SPENT FUELS REPROCESSING | 2176 |
| TRANSPORT AND STORAGE | 2177 |
| MARKETING AND ECONOMICS | 2177 |
| WASTE MANAGEMENT | 2177 |
| *WASTE PROCESSING* | 2178 |
| *WASTE DISPOSAL AND STORAGE* | 2179 |
| ENVIRONMENTAL ASPECTS | 2181 |
| HEALTH AND SAFETY | 2181 |
| REGULATIONS | 2182 |
| *ACCOUNTABILITY AND SAFEGUARDS* | 2182 |
| FUSION FUELS | 2183 |
| PROCESSING | 2183 |
| *FABRICATION AND TESTING* | 2183 |
| BY-PRODUCTS | 2184 |
| ISOTOPE AND RADIATION SOURCE TECHNOLOGY | 2184 |
| PHYSICAL ISOTOPE SEPARATION | 2184 |
| RADIATION SOURCES | 2184 |
| *DESIGN AND FABRICATION* | 2184 |
| *OTHER INDUSTRIAL USES* | 2184 |
| ISOTOPIC POWER SUPPLIES | 2184 |
| HYDROGEN | 2184 |
| PRODUCTION | 2184 |
| *ELECTROLYSIS* | 2185 |
| *THERMOCHEMICAL PROCESSES* | 2185 |
| *BIOSYNTHESIS AND PHOTOCHEMICAL PROCESSES* | 2185 |
| *COAL GASIFICATION* | 2185 |
| *STEAM-IRON PROCESS* | 2185 |
| STORAGE | 2186 |
| *CHEMISORPTION* | 2186 |
| PROPERTIES | 2186 |
| OTHER SYNTHETIC AND NATURAL FUELS | 2186 |
| HYDROCARBON FUELS | 2186 |
| PROPERTIES | 2186 |
| PREPARATION | 2186 |
| *CHEMICAL SYNTHESIS* | 2186 |
| *PREPARATION FROM WASTES OR BIOMASS* | 2186 |
| ALCOHOL FUELS | 2187 |
| PROPERTIES | 2187 |
| *CHEMICAL SYNTHESIS* | 2187 |
| *PREPARATION FROM WASTES OR BIOMASS* | 2187 |
| PREPARATION | 2187 |
| SOLID WASTE FUELS | 2187 |
| LIQUID WASTE FUELS | 2187 |
| HYDRO ENERGY | 2187 |
| RESOURCES AND AVAILABILITY | 2187 |
| SITE GEOLOGY AND METEOROLOGY | 2187 |
| PLANT DESIGN AND OPERATION | 2187 |
| SOLAR ENERGY | 2187 |
| RESOURCES AND AVAILABILITY | 2187 |
| ECONOMICS | 2188 |
| ENVIRONMENTAL, LEGAL, AND INSTITUTIONAL ASPECTS | 2188 |
| SOLAR ENERGY CONVERSION | 2188 |
| *PHOTOVOLTAIC CONVERSION* | 2188 |
| *THERMIONIC AND THERMOELECTRIC CONVERSION* | 2191 |
| *BIOMASS PRODUCTION AND CONVERSION* | 2191 |
| *PHOTOCHEMICAL AND THERMOCHEMICAL CONVERSION* | 2192 |
| SOLAR THERMAL POWER PLANTS | 2193 |
| *CENTRAL RECEIVER* | 2193 |
| *TOTAL ENERGY AND HYBRID SYSTEMS* | 2193 |

| Category | Page |
|---|---|
| OCEAN THERMAL GRADIENT POWER PLANTS | 2194 |
| SOLAR RADIATION UTILIZATION | 2194 |
| *SPACE HEATING AND COOLING* | 2194 |
| *AGRICULTURAL AND INDUSTRIAL PROCESS HEAT* | 2198 |
| *WATER HEATING* | 2198 |
| *OTHER* | 2198 |
| SOLAR COLLECTORS AND CONCENTRATORS | 2198 |
| HEAT STORAGE | 2200 |
| **GEOTHERMAL ENERGY** | 2200 |
| RESOURCE STATUS AND ASSESSMENT | 2201 |
| *USA* | 2201 |
| *NON-USA* | 2201 |
| GEOLOGY, HYDROLOGY, AND GEOTHERMAL SYSTEMS | 2202 |
| *USA* | 2202 |
| *NON-USA* | 2202 |
| GEOTHERMAL EXPLORATION AND EXPLORATION TECHNOLOGY | 2202 |
| *GEOPHYSICAL TECHNIQUES AND SURVEYS* | 2202 |
| *GEOCHEMICAL TECHNIQUES AND SURVEYS* | 2203 |
| LEGAL AND INSTITUTIONAL ASPECTS | 2203 |
| ECONOMIC AND FINANCIAL ASPECTS | 2204 |
| ENVIRONMENTAL ASPECTS AND WASTE DISPOSAL | 2204 |
| GEOTHERMAL POWER PLANTS | 2205 |
| *DESIGN AND OPERATION* | 2205 |
| *POWER PLANT SYSTEMS AND COMPONENTS* | 2205 |
| GEOTHERMAL ENGINEERING | 2205 |
| *DRILLING TECHNOLOGY AND WELL HARDWARE* | 2205 |
| *FLUID TRANSMISSION* | 2205 |
| *CORROSION, SCALING, AND MATERIALS DEVELOPMENT* | 2206 |
| *GEOTHERMAL RESERVOIR AND WELL PERFORMANCE* | 2206 |
| *RESERVOIR STIMULATION AND EXTRACTION TECHNOLOGY* | 2206 |
| DIRECT ENERGY UTILIZATION | 2206 |
| GEOTHERMAL DATA AND THEORY | 2206 |
| *PROPERTIES OF AQUEOUS SOLUTIONS* | 2207 |
| *PROPERTIES OF MINERALS AND ROCKS* | 2207 |
| *ISOTOPE AND TRACE ELEMENT STUDIES* | 2207 |
| **TIDAL POWER** | 2207 |
| TIDAL POWER PLANTS | 2207 |
| **WIND ENERGY** | 2207 |
| AVAILABILITY (CLIMATOLOGY) | 2207 |
| WIND ENERGY ENGINEERING | 2208 |
| *APPLICATIONS* | 2208 |
| *TURBINE DESIGN AND OPERATION* | 2208 |
| **ELECTRIC POWER ENGINEERING** | 2208 |
| POWER PLANTS AND POWER GENERATION | 2208 |
| *COOLING AND HEAT TRANSFER EQUIPMENT AND SYSTEMS* | 2208 |
| *POWER CYCLES* | 2209 |
| *COMPONENTS* | 2209 |
| *WASTE HEAT UTILIZATION* | 2212 |
| *ECONOMICS* | 2212 |
| *OFF-PEAK ENERGY STORAGE* | 2212 |
| *FUELS* | 2212 |
| ENVIRONMENTAL ASPECTS | 2213 |
| *THERMAL EFFLUENTS* | 2213 |
| *NOXIOUS GAS AND PARTICULATE ABATEMENT AND CONTROL* | 2213 |
| *SITE SELECTION AND LAND USE* | 2213 |
| POWER TRANSMISSION AND DISTRIBUTION | 2213 |
| *AC SYSTEMS, EHV AND UHV* | 2215 |
| *SUPERCONDUCTING AND CRYOGENIC SYSTEMS* | 2216 |
| **NUCLEAR POWER PLANTS** | 2216 |
| POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, BOILING WATER COOLED | 2216 |
| POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, NON-BOILING WATER COOLED | 2217 |
| POWER REACTORS, NON-BREEDING, GRAPHITE MODERATED | 2217 |
| POWER REACTORS, NON-BREEDING, OTHERWISE MODERATED OR UNMODERATED | 2218 |
| POWER REACTORS, BREEDING | 2218 |
| REGULATION AND LICENSING | 2220 |
| ECONOMICS | 2220 |
| *CONSTRUCTION AND OPERATION* | 2220 |
| PROCESS HEAT REACTORS | 2220 |
| **NUCLEAR REACTOR TECHNOLOGY** | 2220 |
| THEORY AND CALCULATION | 2221 |
| COMPONENTS AND ACCESSORIES | 2221 |
| FUEL ELEMENTS | 2221 |
| CONTROL SYSTEMS | 2222 |
| ENVIRONMENTAL ASPECTS | 2222 |
| *SITING* | 2222 |
| *RADIOACTIVE EFFLUENTS* | 2222 |
| *CHEMICAL AND THERMAL EFFLUENTS* | 2222 |
| RESEARCH, TEST, AND EXPERIMENTAL REACTORS | 2222 |
| PROPULSION REACTORS | 2222 |
| REACTOR SAFETY | 2223 |
| **ENERGY STORAGE** | 2226 |
| FLYWHEELS | 2226 |
| THERMAL | 2226 |
| BATTERIES | 2226 |
| *DESIGN AND DEVELOPMENT* | 2226 |
| *MATERIALS, COMPONENTS, AND AUXILIARIES* | 2227 |
| **ENERGY MANAGEMENT AND POLICY** | 2227 |
| ENERGY ANALYSIS AND MODELING | 2227 |
| ECONOMICS AND SOCIOLOGY | 2227 |
| ENVIRONMENT, HEALTH, AND SAFETY | 2228 |
| ENERGY RESOURCES | 2228 |
| RESEARCH AND DEVELOPMENT | 2229 |
| NUCLEAR ENERGY | 2230 |
| TRANSPORT AND STORAGE | 2230 |
| WASTE HEAT UTILIZATION | 2230 |
| CONSERVATION | 2230 |
| SUPPLY, DEMAND, AND FORECASTING | 2231 |
| POLICY, LEGISLATION, AND REGULATION | 2232 |
| FOSSIL FUELS | 2232 |
| *COAL* | 2232 |
| *PETROLEUM* | 2232 |
| *NATURAL GAS* | 2233 |
| HYDROGEN AND SYNTHETIC FUELS | 2233 |
| ELECTRIC POWER | 2233 |
| *ELECTRIC POWER GENERATION* | 2234 |
| *ELECTRIC POWER TRANSMISSION AND DISTRIBUTION* | 2234 |
| CONSUMPTION AND UTILIZATION | 2235 |
| *SOLAR* | 2235 |
| *GEOTHERMAL* | 2235 |
| *OTHER* | 2235 |
| **ENERGY CONVERSION** | 2235 |
| MHD GENERATORS | 2235 |
| *DESIGN AND DEVELOPMENT* | 2235 |
| *PERFORMANCE AND TESTING* | 2236 |
| *MATERIALS, COMPONENTS, AND AUXILIARIES* | 2236 |
| *DUCT ENGINEERING AND FLUID DYNAMICS* | 2236 |
| *MATERIALS, COMPONENTS, AND AUXILIARIES* | 2237 |
| FUEL CELLS | 2237 |
| *DESIGN AND DEVELOPMENT* | 2237 |

| Category | Page |
|---|---|
| *MATERIALS, COMPONENTS, AND AUXILIARIES* | 2237 |
| **ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION** | 2237 |
| BUILDINGS | 2237 |
| *RESIDENTIAL BUILDINGS* | 2238 |
| *SCHOOL, MUNICIPAL AND OTHER PUBLIC BUILDINGS* | 2239 |
| *COMMERCIAL AND INDUSTRIAL BUILDINGS* | 2239 |
| TRANSPORTATION | 2240 |
| *AIR AND AEROSPACE* | 2240 |
| *RAILWAY* | 2240 |
| *LAND AND ROADWAY* | 2240 |
| *PIPELINE* | 2240 |
| INDUSTRY AND AGRICULTURE | 2240 |
| *ENERGY SOURCES* | 2241 |
| *MATERIALS* | 2241 |
| *EQUIPMENT AND PROCESSES* | 2241 |
| *WASTE HEAT RECOVERY AND UTILIZATION* | 2243 |
| *INDUSTRIAL WASTE MANAGEMENT* | 2243 |
| MUNICIPALITIES AND COMMUNITY SYSTEMS | 2244 |
| *PUBLIC UTILITIES* | 2244 |
| *MUNICIPAL WASTE MANAGEMENT* | 2244 |
| **ADVANCED AUTOMOTIVE PROPULSION SYSTEMS** | 2244 |
| INTERNAL COMBUSTION ENGINES | 2244 |
| *SPARK-IGNITION* | 2244 |
| *DIESEL* | 2245 |
| *TURBINE* | 2245 |
| *ROTARY* | 2245 |
| EXTERNAL COMBUSTION ENGINES | 2245 |
| *STIRLING CYCLE* | 2245 |
| ELECTRIC-POWERED SYSTEMS | 2245 |
| HYBRID SYSTEMS | 2245 |
| FLYWHEEL PROPULSION | 2245 |
| VEHICLE DESIGN FACTORS | 2245 |
| *ENGINE SYSTEM* | 2246 |
| EMISSION CONTROL | 2246 |
| *NITROGEN OXIDES* | 2246 |
| *CARBON MONOXIDE* | 2246 |
| *HYDROCARBONS* | 2246 |
| ALTERNATIVE FUELS | 2246 |
| **MATERIALS** | 2247 |
| METALS AND ALLOYS | 2247 |
| *PREPARATION AND FABRICATION* | 2247 |
| *STRUCTURE AND PHASE STUDIES* | 2248 |
| *MECHANICAL PROPERTIES* | 2248 |
| *PHYSICAL PROPERTIES* | 2248 |
| *CORROSION AND EROSION* | 2249 |
| *RADIATION EFFECTS* | 2250 |
| CERAMICS, CERMETS, AND REFRACTORIES | 2250 |
| *STRUCTURE AND PHASE STUDIES* | 2250 |
| *MECHANICAL PROPERTIES* | 2250 |
| *PHYSICAL PROPERTIES* | 2250 |
| *CORROSION AND EROSION* | 2251 |
| COMPOSITE MATERIALS | 2251 |
| *PREPARATION AND FABRICATION* | 2251 |
| *MECHANICAL PROPERTIES* | 2251 |
| *PHYSICAL PROPERTIES* | 2251 |
| POLYMERS AND PLASTICS | 2251 |
| *PREPARATION AND FABRICATION* | 2251 |
| *PHYSICAL PROPERTIES* | 2251 |
| OTHER MATERIALS | 2251 |
| *PREPARATION AND MANUFACTURE* | 2251 |
| *STRUCTURE AND PHASE STUDIES* | 2252 |
| *PROPERTIES* | 2252 |
| *RADIATION EFFECTS* | 2252 |
| **CHEMISTRY** | 2252 |
| ANALYTICAL AND SEPARATIONS CHEMISTRY | 2252 |
| *ACTIVATION AND NUCLEAR REACTION PROCEDURES* | 2252 |
| *CHEMICAL PROCEDURES* | 2253 |
| *RADIOMETRIC AND RADIOCHEMICAL PROCEDURES* | 2253 |
| *SPECTRAL PROCEDURES* | 2254 |
| *SEPARATION PROCEDURES* | 2254 |
| INORGANIC AND PHYSICAL CHEMISTRY | 2254 |
| *CHEMICAL AND PHYSICOCHEMICAL PROPERTIES* | 2254 |
| *ISOTOPE EFFECTS* | 2257 |
| *ISOTOPE EXCHANGE AND ISOTOPE SEPARATION* | 2257 |
| ORGANIC CHEMISTRY | 2257 |
| *CHEMICAL AND PHYSICOCHEMICAL PROPERTIES* | 2257 |
| *ISOTOPE EFFECTS* | 2259 |
| ELECTROCHEMISTRY | 2259 |
| PHOTOCHEMISTRY | 2259 |
| RADIATION CHEMISTRY | 2259 |
| RADIOCHEMISTRY AND NUCLEAR CHEMISTRY | 2260 |
| *PROPERTIES OF RADIOACTIVE MATERIALS* | 2260 |
| *RADIOISOTOPE PRODUCTION* | 2260 |
| COMBUSTION CHEMISTRY | 2260 |
| **ENGINEERING** | 2261 |
| FACILITIES AND EQUIPMENT | 2261 |
| *CRYOGENIC AND SUPERCONDUCTING EQUIPMENT AND DEVICES* | 2261 |
| *PROTECTIVE STRUCTURES AND EQUIPMENT* | 2261 |
| *HANDLING EQUIPMENT AND PROCEDURES* | 2262 |
| *SHIPPING CONTAINERS* | 2262 |
| *TRANSPORT AND STORAGE FACILITIES* | 2262 |
| *MINING AND DRILLING EQUIPMENT AND FACILITIES* | 2262 |
| LASERS | 2262 |
| HEAT TRANSFER AND FLUID FLOW | 2267 |
| MATERIALS TESTING | 2267 |
| SAFETY ENGINEERING | 2267 |
| ELECTRONIC CIRCUITS AND DEVICES | 2267 |
| WASTE PROCESSING PLANTS AND EQUIPMENT | 2268 |
| COMBUSTION SYSTEMS | 2268 |
| UNDERGROUND ENGINEERING | 2268 |
| POLLUTION CONTROL EQUIPMENT | 2269 |
| **PARTICLE ACCELERATORS** | 2269 |
| DESIGN, DEVELOPMENT, AND OPERATION | 2269 |
| BEAM DYNAMICS, FIELD CALCULATIONS, AND ION OPTICS | 2270 |
| AUXILIARIES AND COMPONENTS | 2270 |
| *ION SOURCES* | 2271 |
| *INJECTION AND EXTRACTION SYSTEMS* | 2271 |
| *EXPERIMENTAL FACILITIES AND EQUIPMENT* | 2271 |
| STORAGE RINGS | 2271 |
| **INSTRUMENTATION** | 2271 |
| RADIATION INSTRUMENTATION | 2272 |
| *GENERAL DETECTORS AND MONITORS* | 2272 |
| *NUCLEAR SPECTROSCOPIC INSTRUMENTATION* | 2272 |
| *HIGH ENERGY PHYSICS INSTRUMENTATION* | 2272 |
| *RADIOMETRIC INSTRUMENTS* | 2272 |
| RADIATION EFFECTS ON INSTRUMENT COMPONENTS, INSTRUMENTS, OR ELECTRONIC SYSTEMS | 2272 |
| MISCELLANEOUS INSTRUMENTS | 2272 |
| **EXPLOSIONS AND EXPLOSIVES** | 2273 |
| CHEMICAL | 2273 |
| NUCLEAR | 2273 |
| *CIVIL USES* | 2273 |
| *WEAPONRY* | 2273 |
| **ENVIRONMENTAL SCIENCES, ATMOSPHERIC** | 2273 |
| BASIC STUDIES | 2273 |
| *RADIOMETRIC TECHNIQUES* | 2273 |
| CHEMICALS MONITORING AND TRANSPORT | 2274 |

| Category | Page |
|---|---|
| RADIOACTIVE MATERIALS MONITORING AND TRANSPORT | 2275 |
| REGULATIONS | 2278 |
| ENVIRONMENTAL SCIENCES, TERRESTRIAL | 2278 |
| BASIC STUDIES | 2278 |
| CHEMICALS MONITORING AND TRANSPORT | 2279 |
| RADIOACTIVE MATERIALS MONITORING AND TRANSPORT | 2279 |
| *SOIL* | 2279 |
| *TERRESTRIAL ECOSYSTEMS AND FOOD CHAINS* | 2279 |
| SITE RESOURCE AND USE STUDIES | 2280 |
| REGULATIONS | 2280 |
| ENVIRONMENTAL SCIENCES, AQUATIC | 2280 |
| BASIC STUDIES | 2280 |
| CHEMICALS MONITORING AND TRANSPORT | 2280 |
| RADIOACTIVE MATERIALS MONITORING AND TRANSPORT | 2281 |
| *WATER* | 2281 |
| *AQUATIC ECOSYSTEMS AND FOOD CHAINS* | 2281 |
| THERMAL EFFLUENTS MONITORING AND TRANSPORT | 2281 |
| SITE RESOURCE AND USE STUDIES | 2282 |
| REGULATIONS | 2282 |
| ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES | 2282 |
| SOCIAL AND ECONOMIC STUDIES | 2282 |
| ASSESSMENT OF ENERGY TECHNOLOGIES | 2282 |
| ENVIRONMENTAL IMPACT STATEMENTS | 2282 |
| BIOMEDICAL SCIENCES, BASIC STUDIES | 2282 |
| BIOCHEMISTRY | 2282 |
| *TRACER TECHNIQUES* | 2282 |
| CYTOLOGY | 2282 |
| GENETICS | 2283 |
| METABOLISM | 2283 |
| MEDICINE | 2283 |
| *TRACER TECHNIQUES* | 2283 |
| PATHOLOGY | 2283 |
| PHYSIOLOGICAL SYSTEMS | 2284 |
| *TRACER TECHNIQUES* | 2284 |
| PUBLIC HEALTH | 2284 |
| AGRICULTURE AND FOOD TECHNOLOGY | 2284 |
| BIOMEDICAL SCIENCES, APPLIED STUDIES | 2284 |
| RADIATION EFFECTS ON BIOCHEMICALS | 2284 |
| *IN ANIMALS* | 2284 |
| RADIATION EFFECTS ON CELLS | 2284 |
| *EXTERNAL SOURCE* | 2284 |
| *INTERNAL SOURCE* | 2284 |
| RADIATION EFFECTS ON MICROORGANISMS | 2284 |
| *BASIC STUDIES* | 2284 |
| RADIATION EFFECTS ON PLANTS | 2285 |
| *BASIC STUDIES* | 2285 |
| RADIATION EFFECTS ON ANIMALS | 2285 |
| *MAN* | 2285 |
| *VERTEBRATES* | 2285 |
| *INVERTEBRATES* | 2285 |
| *PEST CONTROL* | 2285 |
| *MAN* | 2286 |
| NUCLIDE KINETICS AND TOXICOLOGY | 2286 |
| *MAN* | 2286 |
| *ANIMALS* | 2286 |
| *PLANTS* | 2286 |
| *MICROORGANISMS* | 2286 |
| CHEMICALS METABOLISM AND TOXICITY | 2286 |
| *CELLS* | 2287 |
| *MICROORGANISMS* | 2287 |
| *PLANTS* | 2287 |
| *INVERTEBRATES* | 2287 |
| *VERTEBRATES* | 2287 |
| *MAN* | 2288 |
| OTHER ENVIRONMENTAL POLLUTANT EFFECTS | 2288 |
| HEALTH AND SAFETY | 2288 |
| GEOSCIENCES | 2288 |
| GEOLOGY AND HYDROLOGY | 2288 |
| GEOPHYSICS | 2288 |
| *SEISMOLOGY AND TECTONICS* | 2288 |
| *GEOPHYSICAL SURVEY METHODS* | 2288 |
| MINERALOGY, PETROLOGY, AND ROCK MECHANICS | 2288 |
| GEOCHEMISTRY | 2289 |
| OCEANOGRAPHY | 2289 |
| PHYSICS RESEARCH | 2289 |
| ASTROPHYSICS AND COSMOLOGY | 2289 |
| *COSMIC RADIATION* | 2289 |
| *STARS* | 2289 |
| *QUASI-STELLAR, RADIO, AND X-RAY SOURCES* | 2289 |
| *SOLAR PHENOMENA* | 2290 |
| *GALAXIES* | 2290 |
| *PLANETARY PHENOMENA* | 2290 |
| ATMOSPHERIC PHYSICS | 2290 |
| *AURORAL AND IONOSPHERIC PHENOMENA* | 2290 |
| ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS | 2291 |
| *BEAMS AND THEIR REACTIONS* | 2291 |
| *ATOMIC AND MOLECULAR PROPERTIES* | 2291 |
| *POSITRONIUM, MUONIUM, AND MUONIC AND MESIC ATOMS AND MOLECULES* | 2292 |
| *COLLISION PHENOMENA* | 2292 |
| *ATOMIC AND MOLECULAR THEORY* | 2292 |
| GENERAL FLUID DYNAMICS | 2292 |
| MAGNETOHYDRODYNAMICS | 2292 |
| OTHER QUANTUM FLUIDS | 2292 |
| HIGH ENERGY PHYSICS | 2292 |
| PARTICLE INTERACTIONS AND PROPERTIES - EXPERIMENTAL | 2293 |
| *ELECTROMAGNETIC INTERACTIONS* | 2293 |
| *WEAK INTERACTIONS* | 2293 |
| *STRONG BARYON-INDUCED INTERACTIONS* | 2293 |
| *STRONG MESON-INDUCED INTERACTIONS* | 2294 |
| PARTICLE INTERACTIONS AND PROPERTIES - THEORETICAL | 2294 |
| *GENERAL* | 2294 |
| *ELECTROMAGNETIC INTERACTIONS* | 2294 |
| *WEAK INTERACTIONS* | 2294 |
| *STRONG INTERACTIONS, GENERAL* | 2294 |
| *STRONG INTERACTIONS, BARYON NO. = 0* | 2295 |
| *STRONG INTERACTIONS, BARYON NO. GREATER THAN 1* | 2295 |
| PARTICLE INVARIANCE PRINCIPLES AND SYMMETRIES | 2295 |
| *APPLICATIONS TO STRONG INTERACTIONS* | 2295 |
| PHYSICS RESEARCH (CONT.) | 2295 |
| NUCLEAR PHYSICS | 2295 |
| *ENERGY LEVELS AND TRANSITIONS* | 2295 |
| NUCLEAR PROPERTIES AND REACTIONS, A = 6-19, EXPERIMENTAL | 2295 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2295 |
| NUCLEAR PROPERTIES AND REACTIONS, A = 90-149, THEORETICAL | 2295 |
| *ENERGY LEVELS AND TRANSITIONS* | 2295 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2295 |
| NUCLEAR PROPERTIES AND REACTIONS, A = 90-149, EXPERIMENTAL | 2296 |
| *RADIOACTIVE DECAY* | 2296 |
| *ENERGY LEVELS AND TRANSITIONS* | 2296 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2296 |
| NUCLEAR PROPERTIES AND REACTIONS, A = 150-189, EXPERIMENTAL | 2296 |
| *RADIOACTIVE DECAY* | 2296 |
| *ENERGY LEVELS AND TRANSITIONS* | 2296 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2297 |

| Category | Page |
|---|---|
| NUCLEAR PROPERTIES AND REACTIONS, A=190-219, THEORETICAL | 2297 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2297 |
| NUCLEAR PROPERTIES AND REACTIONS, A=190-219, EXPERIMENTAL | 2297 |
| *RADIOACTIVE DECAY* | 2297 |
| *ENERGY LEVELS AND TRANSITIONS* | 2297 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2297 |
| NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, THEORETICAL | 2297 |
| *MASS, ABUNDANCE, AND BINDING ENERGY* | 2297 |
| *SPONTANEOUS AND INDUCED FISSION* | 2297 |
| NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, EXPERIMENTAL | 2297 |
| *MASS, ABUNDANCE, AND BINDING ENERGY* | 2297 |
| *RADIOACTIVE DECAY* | 2297 |
| *SPONTANEOUS AND INDUCED FISSION* | 2298 |
| NUCLEAR THEORY | 2298 |
| *NUCLEAR REACTIONS AND SCATTERING* | 2298 |
| *RADIOACTIVE DECAY* | 2298 |
| RADIATION AND SHIELDING PHYSICS | 2298 |
| *RADIATION PHYSICS* | 2298 |
| *NEUTRON INTERACTIONS WITH MATTER* | 2298 |
| MEDICAL PHYSICS | 2299 |
| *DOSIMETRY* | 2299 |
| SOLID STATE PHYSICS | 2299 |
| SUPERCONDUCTIVITY | 2299 |
| *GENERAL THEORY* | 2299 |
| *ACOUSTIC, ELECTRIC, MAGNETIC, OPTICAL, AND THERMAL PHENOMENA* | 2300 |
| THEORETICAL PHYSICS | 2300 |
| *CLASSICAL AND QUANTUM MECHANICS* | 2300 |
| *OPTICS* | 2300 |
| *STATISTICAL PHYSICS AND THERMODYNAMICS* | 2300 |
| MATHEMATICAL PHYSICS | 2300 |

| Category | Page |
|---|---|
| COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY | 2300 |
| FUSION ENERGY | 2300 |
| PLASMA RESEARCH | 2300 |
| *PLASMA CONFINEMENT AND HEATING* | 2300 |
| *PLASMA DIAGNOSTICS* | 2301 |
| *PLASMA KINETICS - GENERAL* | 2303 |
| *PLASMA KINETICS - EXPERIMENTAL* | 2304 |
| *PLASMA KINETICS - THEORETICAL* | 2304 |
| *PLASMA PRODUCTION* | 2306 |
| *PLASMA INSTABILITIES* | 2306 |
| *PLASMA WAVE PHENOMENA* | 2309 |
| FUSION POWER PLANT TECHNOLOGY | 2311 |
| *BLANKET ENGINEERING* | 2314 |
| *MAGNET COILS AND FIELDS* | 2315 |
| *POWER SUPPLIES, ENERGY STORAGE* | 2316 |
| *COOLING SYSTEMS* | 2317 |
| *HEATING AND FUELING SYSTEMS* | 2317 |
| *TRITIUM PROCESSING, ENVIRONMENT AND SAFETY* | 2319 |
| *INERTIAL CONFINEMENT TECHNOLOGY* | 2319 |
| *COMPONENT DEVELOPMENT AND MATERIALS TESTING* | 2322 |
| GENERAL AND MISCELLANEOUS | 2323 |
| MANAGEMENT | 2323 |
| MATHEMATICS AND COMPUTERS | 2323 |
| INFORMATION HANDLING | 2324 |
| CORPORATE INDEX | 1C |
| AUTHOR INDEX | 15A |
| SUBJECT INDEX | 49S |
| REPORT NUMBER INDEX | 145R |
| CONTRACT NUMBER INDEX | 140CN |

## STAFF OF ENERGY RESEARCH ABSTRACTS

**Editor and Production Manager**
David E. Bost

**Assistant Editor**
Lee M. Thompson

**Associate Editors**
M. Catherine Grissom
Robert C. Kelly
Sidney F. Lanier
Henry D. Raleigh
Lila B. Smith
Charles E. Stuber

**Report Evaluators**
William D. Matheny
John H. Mitchell
Mary H. Newman
Ted Redmon

**Descriptive Cataloging Specialist**
J. Paul Meredith

**Subject Heading Specialist**
Dora H. Moneyhun

**Corporate Author Specialist**
Clara L. Fox

**Report Number Specialist**
M. Gwen Gaither

**Computer Processing Coordinator**
Noboru Kawakami

**Information Specialists**
P. Martin Alexander
E. Ray Bedford
Jane G. Buchanan
D. Lamar Cason
David C. Cunningham
Theodore F. Davis
James R. Dulaney
Stanley D. Frey
Darrell O. Galde
Everett J. Hoffman
Carolyn D. Houston
Dona C. Keller
Lynda H. Kern
W. Hugh Kinser
Lisbeth C. Lieberman
Betty L. McDowell
Lorne T. Newman
Jean F. Peckham
Mona H. Raridon
Julia S. Redford
Stanley J. Rimshaw
Jessie W. Rushing
Robert W. Rutkowski
Francis L. Sachs
Polly C. Summers
George H. Thoeming
Helen L. Ward
Milton O. Whitson
Martha C. Wilson

**Publishing Coordinator**
Charles R. Bruce

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts*, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

---

*The Secretary of the U. S. Department of Energy has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.*

Volume 3, Number 9, May 15, 1978

# ENERGY RESEARCH ABSTRACTS

## COAL AND COAL PRODUCTS

*REFER ALSO TO CITATION(S) 21725*

**20840** (FE—2479-1) **Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976—August 1977.** Lewis, D.W.; Allaire, P.E. (Virginia Univ., Charlottesville (USA). Research Labs. for the Engineering Sciences). Nov 1977. Contract EX-76-C-01-2479. 91p. Dep. NTIS, PC A05/MF A01.

Research is reported on machinery performance, machinery design and criteria, preventive maintenance, computer programs for analysis of rotating machinery and rotor dynamics measurements. (JRD)

## PROCESSING

*REFER ALSO TO CITATION(S) 20942, 21522*

**20841** (CONF-7706100—) **Fossil energy research meeting.** Kropschot, R.H.; Phillips, G.C. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Physical Research). Dec 1977. 560p. Dep. NTIS, PC A24/MF A01.

From Fossil energy research meeting; Washington, DC, USA (28 Jun 1977).

U.S. ERDA's research programs in fossil energy are reviewed with brief descriptions, budgets, etc. Of general interest are discussions related to the capabilities for such research of national laboratories, universities, energy centers, etc. Of necessity many items are treated briefly, but a general overview of the whole program is provided. (LTN)

### CARBONIZATION

**20842** **Coke-oven performance on coarsened charge.** Schneider, E.M. *Coke Chem., USSR (Engl. Transl.);* No. 3, 8-10(1976).

Output requirements demanded that No. 2 oven battery at Cherepovetsk Metals work on a charge composed of 66% - 3mm. This was found impossible because of unacceptably low temperatures in the oven wall lining below the heating flues. The best that could be achieved was 72 to 75% -3mm, but this meant undercharging. A compromise appears to have been reached by increasing the total percentage of 1 to 3mm and 3 to 6mm and this was achieved by replacing the conventional crushing by a fast-running crusher.

**20843** **Coke yield from the charge.** Didenko, V.S. *Koks Khim.;* No. 2, 13-17(Feb 1977).

The principal technical factors controlling the coke yield are the properties of the coal constituents, essentially the volatile matter and the coking conditions, in particular the end temperature. Other nontechnical factors relate to the composition of the coal supply, deliveries of coal, accuracy of masurement of coal stocks, and quality control procedures. Formulae are put forward to take account of the nontechnical factors, together with correction factors. The formulae can be used in planning and control of operations.

**20844** **Pilot commercial carbonization of 50% gas—coal blends.** Miroshnichenko, A.M.; Shtromberg, B.I.; Pukhal'skaya, V.A.; Grechko, Yu.I.; Morozova, V.I.; Shchelkunov, F.S.; Gurevich, N.A.; Pchelin, V.E. (Kharkov Experimental Coke and Chemical Works). *Coke Chem., USSR (Engl. Transl.);* No. 8, 5-6(1976).

Translated from Koks Khim.; No. 8, 3-5(1976).

The reserves of coking coals in the Donbas consist largely of grade G coals, and the proportions included in carbonization charges for Ukrainian plants are consequently increasing systematically. This makes it particularly important to utilize the available coal supplies rationally, in line with their processing properties. One possibility is to allocate different blends for carbonization in the individual Ukrainian plants. Investigations have shown that quality metallurgical coke can be made provided plants are not required to blend high proportions of both types of poor-caking coals, viz. grades G and OS, in the same charge.

**20845** **Influence of charge moisture contents on carbonization periods.** Bronnikov, V.K. *Coke Chem., USSR (Engl. Transl.);* No. 8, 17-19(1976).

Translated from Koks Khim.; No. 8, 12-13(1976).

Commercial test data are presented on the extent to which moisture in the charge influences its bulk density and the carbonization period. In the Yasinovka plant a charge moisture content of 8% is the optimum in view of its effects on the carbonization period and the bulk density of the charge.

### DESULFURIZATION AND PURIFICATION

*REFER ALSO TO CITATION(S) 20878, 20884, 20902, 20918*

**20846** **Raman spectra of supported molybdcna catalysts. II. Sulfided, used, and regenerated catalysts.** Brown, F.R.; Makovsky, L.E.; Rhee, K.H. (Dept. of Energy, Pittsburgh). *J. Catal.;* **50**: No. 3, 385-389(Dec 1977).

Raman spectroscopy has been used to investigate the structural changes that two supported molybdenum oxide catalysts undergo upon specific chemical treatments. Molecular $MoS_2$ structures are indicated after sulfidation by a mixture of $H_2/H_2S$. Catalyst samples used in a coal hydrodesulfurization process yield spectra dominated by intense scattering from carbon deposited in the pores of the catalyst. Spectra of used catalyst samples, subjected to controlled air-firing to 600°C, show that all of the spectral features of the unused catalyst are not recovered after this "regeneration" procedure.

**20847** **Method for desulfurizing char by acid washing and treatment with hydrogen gas.** Robinson, L.; Sass, A. (to Occidental Research Corp.). US Patent 4,054,421. 18 Oct 1977. Filed date 30 Apr 1976. 8p.

This invention covers a process for reducing the sulfur content of char by washing the char with an acid followed by treatment with hydrogen gas.

### HYDROGENATION

*REFER ALSO TO CITATION(S) 20878, 20883*

**20848** **Residence time measurements in a coal hydrogenation process.** Lytle, J.M.; Wood, R.E.; Wiser, W.H.; Mladejovsky, M.G. (Univ. of Utah, Salt Lake City). *Fuel Process. Technol.;* **1**: No. 2, 95-102(Jan 1978).

Residence time of coal in the University of Utah "coiled tube" coal hydrogenation reactor has been measured. This has been done with an electronic device which detects a tracer (usually iron) as it passes specific places at the beginning and end of the reactor. The measured coal solids residence time in the reactor has varied from a few seconds to a few minutes. Calculated vapor and gas residence times are one or two seconds. Short vapor residence time terminates further hydrogenation of vapors and thus reduces gas production and hydrogen consumption. The relatively longer coal solids residence time permits further hydrogenation which increases liquid yields.

## GASIFICATION

*REFER ALSO TO CITATION(S) 20875, 20889, 20904, 20912, 21252, 21257, 21388, 21467, 21474, 21475, 21476, 21477, 21478, 21513, 21726, 21924*

**20849** (CONF-771145—2) **Report of survey of valve industry capabilities.** Bush, W.A.; Slade, E.C. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 24p. Dep. NTIS, PC A02/MF A01.

From Workshop on valves for solids handling service in coal conversion; Morgantown, WV, USA (14 Nov 1977).

To evaluate the valve requirements associated with coal conversion, seven prospective coal conversion design concepts were studied; flow streams were determined; valve types were assigned and the valves were sized. At present, it appears that the coal conversion processes operate in the range of the present petrochemical industry, except for that portion of the process where the coal is converted to gas and oil. The analysis resulted in the identification of twenty-four high temperature valve applications that appeared more stringent than the petrochemical industry needs. To determine the industry capability to supply valves for these applications, questionnaires were mailed to two hundred and thirty-one valve manufacturers. Although the results of the survey show that the valve industry is capable of manufacturing, in quantity, equipment of the size and for the pressure and temperature range which would be required in the coal conversion industry; valve manufacturers do not have product application experience to predict the continuing functional ability of valves used for lock hopper feeders, slurry feeders and for slag/char let-down service. Developmental and testing efforts to modify existing valve design or develop new valve concepts for these applications were estimated to range from one to six years. A testing facility to simulate actuation of critical valves under service conditions would be beneficial.

**20850** (CONF-780305—1) **Petrographic method for selective determination of a component (raw coal) in a mixture of products from processing of coal.** Mason, D.M.; Julian, Y. (Institute of Gas Technology, Chicago, Ill. (USA)). 1978. Contract EX-76-C-01-1221. 8p. Dep. NTIS, PC A02/MF A01.

From Division of fuel chemistry meeting; Anaheim, CA, USA (12 Mar 1978).

In the HYGAS pilot plant gasification reactor, fine particles from each reactor stage become entrained in the gas and are carried into the exit-gas cyclone and are removed from the gas. Thus, the dust removed by the pilot plant cyclone includes particles from the steam-oxygen-gasification fluidized bed, the second-stage hydrogasification fluidized bed, the first-stage hydrogasification entrained reactor, and the slurry drier fluidized bed. For an understanding of the process, it is desirable to estimate the amount of feed coal carried out of the reactor from the slurry drier bed. To fill this need, we have developed a petrographic method for determining the feed coal content of samples of dust collected from the cyclone. The method was developed on samples obtained when the pilot plant was operating on lignite, but it should also be applicable to samples from the processing of other ranks of coal.

**20851** (CONF-7603113—, pp C1-C18) **Coal gasification: when.** Clarke, D.K. (Stearns-Roger Inc., Denver). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Developments in coal gasification since 1974 are reviewed. Technology has progressed, though more slowly than projected. Reliable plants for pipeline gas from coal can be built with present technology and with adequate environmental safeguards. Understanding of financing problems has made major progress. It is known that synthetic fuels commercialization will require federal support programs. A greatly improved understanding of plant costs has developed. A demonstration plant program for new coal gasification technology is proceeding, with operations scheduled for 1980-82. A government support program for commercialization has been issued. Review and discussion should permit its revision for both industry and government acceptance. Provided funds are made available by 1976-7, six coal gasification plants, producing about 0.6 TCF of pipeline gas per year, could be onstream by 1985. If there are no funds, or equivalent incentives, there will be no commercial plants. (JRD)

**20852** (DOE/JPL/2616—2) **Coal pump development and technical support. Quarterly project report. Report No. 2.** Murphy, A.; Phen, R.; Schatz, W. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 3 Jul 1977. Contract EF-77-A-01-2616. 33p. (TSR—77/2). Dep. NTIS, PC A03/MF A01.

Under an ERDA contract, comparative evaluations of fuel feeding systems under development for coal conversion plants have been made and recommendations with respect to further work on each are made. Under another part of the contract, feasibility studies are being made with respect to a coal extruder or "pump" based on the plastic properties of coal. Based on a poor response to letters of interest to industrial companies with respect to this project, JPL has proposed to ERDA that JPL buy an extruder and test it in-house with consulting help from the extruder manufacturer. (LTN)

**20853** (EPRI-AF—558) **Engineering review and evaluation of Combustion Engineering, Inc., coal gasification process development unit. Final report.** Daniels, L.S. (Bechtel Corp., San Francisco, Calif. (USA)). Dec 1977. 42p. Dep. NTIS, PC A03/MF A01.

Electric Power Research Institute is cofounder with the United States Energy Research and Development Administration for a Combustion Engineering, Inc., project to design, construct, and test a process development unit for coal gasification that makes low-Btu fuel gas for electric power applications. The process under investigation is an air-blown, two-stage, atmospheric-pressure, entrainment-type gasification system using a gasifier that is in many details similar to established commercial boiler designs. This report is an engineering evaluation of the process, facility, and test program.

**20854** (FE—1770-26) **Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977—March 31, 1977.** Blake, T.R. (Systems, Science and Software, La Jolla, Calif. (USA)). May 1977. Contract EX-76-C-01-1770. 32p. (SSS-R—77-3205). Dep. NTIS, PC A03/MF A01.

This was the third quarter in the second year of research to develop and apply computer codes, based upon continuum theories of multiphase flows, to the performance of fluidized bed and entrained flow coal gasification reactors. Research was active in several areas. The research on the fluidized bed model was directed to the continued development of the chemistry for steam-oxygen gasification and to the incorporation of that chemistry into the numerical formulation. In addition, theoretical studies were continued or initiated on compressibility effects in fluidized beds, mechanical interaction functions, constitutive relationships and particle size effects. The work on the entrained flow model included a continued formulation of the equations for turbulent gas-solid particle motion, the examination of chemical kinetics and the successful completion of a model computer code appropriate to representing transient entrained flows. This latter code, which involves a finite element-finite difference formulation has been applied to study swirling flows of a compressible viscous gas.

**20855** (FE—2015-20) **Development program for MHD power generation: coal devolatilization. Final report, Volume VI, July 1, 1975—September 30, 1976.** Ubhayakar, S.K.; Gannon, R.; Stickler, D. (Avco-Everett Research Lab., Inc., Everett, Mass. (USA)). Apr 1977. Contract EX-76-C-01-2015. 88p. Dep. NTIS, PC A05/MF A01.

One of the many MHD power cycles which look attractive for producing electric power from coal is the Chemical Regeneration Cycle. In this cycle, pulverized coal is injected into and entrained in the hot exhaust of an MHD power genertor. A large percentage (approximately 70%) of the entrained coal devolatilizes under the rapid heating conditions, and the devolatilized fraction reacts endothermically with the steam and carbon dioxide in the exhaust to produce a fuel gas rich in carbon monoxide and hydrogen. In order to understand the various physico-chemical processes occurring in such a gasifier, an experimental and analytical study was conducted. In this study, pulverized bituminous coal was injected and entrained in hot combustion gases flowing in a constant cross-section gasifier. In this report, data on the weight loss through rapid pyrolysis, on the temperature of the heterogeneous medium, and on the composition of the overall products are presented, and are correlated with an analytical model incorporating two competitive first-order Arrhenius reactions. All data pertain to tests conducted at a pressure of one atm. Heating rates up to $10^5$ °K/s and volatile product yields up to 70% of the original dry, ash-free coal were observed. Analysis of the data suggests that a significant fraction of these products crack to soot and hydrogen, and that the cracking fraction increases with the coal fraction in the input gases. Refinements in the chemical regeneration cycle analysis using the experimental data are indicated. The results of exploratory experiments to measure the amount of seed that reacts with the ash/slag during rapid devolatilization are presented. The coal devolatilization reactor was modified to study the devolatilization and burnout of the coal particles in hot oxidizing atmospheres. Design parameters on coal injection nozzles, and other experimental data are presented.

**20856** (FE—2355-2(Rev.D)) **Coal gasification valves, Phase II. Quarterly technical progress report, June 1977—August 1977.** (Consolidated Controls Corp., El Segundo, Calif. (USA)). Oct 1977. Contract EX-76-C-01-2355. 30p. Dep. NTIS, PC A03/MF A01.

Effort in the design of valves to operate at high temperature in coal gasification plants are detailed. A considerable part of the work involves determining the properties of materials, such as ceramics, which may be satisfactory at these temperatures. The particular properties measured were porosity, permeability, thermal expansion, resistance to mechanical and thermal shock, etc. With

these properties known, the problem then was to design the valves to operate within the limits of these properties. Prototype valves are being designed and fabricated for testing. (LTN)

**20857** (FE—2414-4) **Remote electromagnetic sensing of underground coal burns. Quarterly technical progress report, March—May 1977.** Quincy, E.A. (Wyoming Univ., Laramie (USA). Dept. of Electrical Engineering). Jun 1977. Contract EX-76-S-01-2414. 36p. Dep. NTIS, PC A03/MF A01.

The main objective of this research project is to develop and field test an induction system and estimator algorithm for remote determination (at the surface) of the location, shape and size of underground coal burn voids. New computer programs were developed for an induction system response during a traverse over a simplified model of an underground coal burn. Calculated results are presented for square metal plate and rectangular box models of the burn region in a homogeneous conducting medium. A family of curves for depth of penetration versus probing frequency are given as a function of overburden electrical parameters. Reference induction responses obtained over an undisturbed site are presented in both the time and frequency domains for three different system positions. Performance tests on the previously developed Bayes estimators for the radius of a conducting cylinder were recomputed. The number of radius samples was increased from 25 to 100 in order to provide better averaging in the Monte Carlo simulation. Typical estimates, sample mean, mean-square-error and variance are shown as a function of sample size.

**20858** (FE—2467-4) **Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976—July 31, 1977.** Rosynek, M.P. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). Aug 1977. Contract EX-76-C-01-2467. 112p. Dep. NTIS, PC A06/MF A01.

Sodium- and potassium-graphite intercalates, although possessing high initial activities for the Fischer-Tropsch synthesis, do not behave catalytically for this reaction. A large fraction of carbon monoxide reactant becomes unreactively adsorbed on these materials, probably via formation of stable carbonyl-type structures, and inhibits the overall reaction rate. Furthermore, a permanent and irrecoverable loss of activity occurs after only brief usage, due to alkali metal destruction by the water molecules that are necessarily formed during reaction. With only minor variations, the behavior of potassium-reduced iron-graphite is similar to that of pure potassium-graphite. Removal of potassium-containing by-products from this material prior to use imparts behavior similar to that of an alumina-supported iron catalyst, but does not prevent the eventual, permanent loss of catalytic activity. The activity for Fischer-Tropsch conversion of a commercially-available metal aryl-reduced iron-graphite intercalate decreases with increasing reaction time, but eventually becomes stabilized at a level that is relatively independent of pretreatment conditions. The overall activity of this material is similar to that of a commercial iron/alumina catalyst, but its selectivity characteristics in the temperature range 225 to 325°C are considerably different. The iron-graphite intercalate produces substantially smaller amounts of carbon dioxide and larger amounts of $C_2^+$ hydrocarbon products at one atmosphere pressure than does the iron/alumina catalyst under identical conditions.

**20859** (MIT—2295T9-1) **Computer-aided industrial process design: the ASPEN project. First quarterly progress report, June 1—August 31, 1976.** (Massachusetts Inst. of Tech., Cambridge (USA)). 15 Sep 1976. Contract EX-76-C-01-2295-009. 143p. Dep. NTIS, PC A07/MF A01.

Progress was made on important aspects of the project: (1) Preliminary planning and organization of the project was done through meetings between the ERDA staff and the project staff at M.I.T. (2) Identification of existing industrial software that might be available for incorporation in the system was begun. The acquisition of existing software will avoid costly reduplication of programming and will permit us to build upon present technology to develop a third generation system. (3) The prototype simulator, PLEXSYS, has been further developed. PLEXSYS will provide the framework for simulation of three fossil energy processes and for the preliminary implementation of the physical property system. PLEXSYS will be developed in the FORTRAN programming language. (4) The HYGAS process for coal gasification was selected as the first of three fossil energy processes to be simulated using the prototype simulator. (5) Progress was made on the preliminary design of a physical property system. A report was prepared dealing with the aspects of modularity and routing required in the physical property system.

**20860** (MIT—2295T9-2) **Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1—November 30, 1976.** (Massachusetts Inst. of Tech., Cambridge (USA)). 15 Dec 1976. Contract EX-76-C-01-2295-009. 117p. Dep. NTIS, PC A06/MF A01.

This paper describes a project to develop an advanced computing system for process engineering. Although industry has developed proprietary computer programs for simulation of process flowsheets, these programs are not publicly available, are not suitable for new energy processes involving solids, do not utilize current computing technology, and are not integrated. Preliminary work led to a plan to develop a next-generation system, tentatively called ASPEN (Advanced System for Process Engineering). For a process such as a coal gasification plant, ASPEN would perform the steady-state material and energy balances, size the equipment, and carry out an economic evaluation. This paper explains how ASPEN will be used to solve energy problems in process development, in policy planning and in systems research. The plan of development over three years, with the active cooperation of industry, is described.

**20861** (PB—269557) **Evaluation of background data relating to new source performance standards for Lurgi gasification. Final report September 1976—February 1977.** Sinor, J.E. (Cameron Engineers, Inc., Denver, Colo. (USA)). Jun 1977. Contract EPA-68-02-2152. 226p. NTIS PC A11/MF A01.

The report contains information on expected emissions from a large coal gasification complex based on Lurgi technology. Use of best available control technology was assumed and two different schemes for sulfur removal were examined. The coal gasification plant was divided into 15 sections: each section is discussed in a separate chapter. Areas were identified in which projected emissions data were deemed inadequate for evaluation of environmental impact. Desirable information presently lacking in other areas is summarized.

**20862** (SAND—77-1821) **Instrumentation and process control development for in situ coal gasification. Tenth and eleventh quarters' report: March—August 1977.** Northrop, D.A. (ed.). (Sandia Labs., Albuquerque, N.Mex. (USA)). Dec 1977. Contract EY-76-C-04-0789. 35p. Dep. NTIS, PC A03/MF A01.

Fielding of the instrumentation effort associated with the Hanna IV experiment is nearly completed. Thirty-one wells and an extensive surface probe array have been emplaced and will be used for the eight instrumentation techniques (thermal, in-seam gas sampling and pressure, subsidence, passive acoustic, two remote electrical methods, and a high-resolution seismic survey) to be used and evaluated on this test. Final cable terminations, checkout and background data will be collected prior to the scheduled initiation of the test in early October. A field data acquisition system utilizing a minicomputer has been assembled in a reconditioned field instrumentation trailer and sent to the Hanna site. This system will provide an essentially real-time data reduction and display capability for the different instrumentation techniques. A comprehensive assessment of the instrumentation techniques fielded and evaluated on the Hanna II in situ coal gasification experiment has been completed.

**20863** **Scaling laws and the differential equations of an entrained flow coal gasifier.** Kane, R.S. (Manhattan Coll., Riverdale, NY); McCallister, R.A. *AIChE J.;* **24**: No. 1, 55-63(Jan 1978).

A formal order of magnitude analysis was applied to the differential equations describing mass, momentum, and energy transport in an axially translating, vortex flow field and used to determine the importance of various terms. Significant dimensionless parameters, suitable for establishing scaling laws, appear naturally from the equations. Among the important parameters are the swirl number, geometric scale ratio, Froude number, and particle loading ratio. These parameters were combined to establish rules for complete similarity between a model and a prototype gasifier.

**20864** **Electrofluid gasification of coal with nuclear energy.** Pulsifer, A.H.; Wheelock, T.D. (Ames Lab., IA). *Fuel Process. Technol.;* **1**: No. 2, 117-132(Jan 1978).

The gasification of coal by reaction with steam requires addition of large amounts of energy. This energy can be supplied by a high-temperature nuclear reactor which is coupled to a fluidized bed gasifier either thermally or electrically via an electrofluid gasifier. A comparison of the economics of supplying energy by these two alternatives demonstrates that electrofluid gasification in combination with a high-temperature nuclear reactor may in some circumstances be economically attractive. In addition, a review of recent experiments in small-scale electrofluid gasifiers indicates that this method of gasification is technically feasible.

**20865** **Coal gasification and South Africa.** Clark, D. *Coal, Gold Base Miner. South. Afr.;* **25**: No. 10, 93, 97, 101, 105, 111-112(Oct 1977).

Lacking the cheap indigenous hydrocarbon resources of the Western World, South Africa has continued to generate fuel and process gases from its relatively cheap coal. This has helped towards a measure of strategic and economic self sufficiency. The papers, delivered at the recent Energy Today and Tomorrow symposium, review the current status of the technology, some of its problems, and its future potential. South Africa has three gasworks--Cape Town, Port Elizabeth and Johannesburg. The basic processes operated are: (a) coal carbonization, which produces gas, coke and by-

products, and (b) carburetted water gas manufacture from coke and oil.

**20866 Development trends in coal gasification.** Juentgen, H. *Bergbau;* **28**: No. 9, 347-355(Sep 1977). (In German).

Further developments in coal gasification are aimed at increasing the economy of conventional gasification processes, in the context of which it is also tried to step up the gasification pressure. On a long-term basis, the use of process heat from HTRs is to be expected, which will result in coal being saved, emission being lowered, and the economy being greater in the case of expensive coal being used as against conventional processes. Furthermore, the development of new gasification processes also serves the target to use national coal for the production of secondary energy in a way not harmful to the environment. In this connection two ways for the production of SNG are tried out worldwide, and the generation of electricity is also put on a new basis by a combined gasification/combustion process.

**20867 In-situ coal gasification. Part of the energy research program of the Federal government.** Neumann, R. *VDI (Ver. Dtsch. Ing.) Nachr.;* **31**: No. 34, 10(Aug 1977). (In German).

The basic programme energy research 1974-1977 (nonnuclear energy research) of the Federal government also promotes the development of in-situ coal gasification techniques, because this technique is basically suited to contribute to the aims of the energy research programme. Deposit resources which appear to be suitable for in-situ gasification and which cannot be obtained by means of conventional mining techniques, amount to at least 20 billion tons, may be even 100 billion tons, of coal. In the meantime, the project management at the Kernforschungsanlage Juelich has elaborated concept, programme and projects for the development of a special technique adapted to the specific deposit conditions of German coal. The technique is described briefly.

**20868 Gasification as a first step to using coal as a fuel and raw material.** Wurzbacher, G. (Uhde (F.) G.m.b.H., Dortmund (Germany, F.R.)). *CZ-Chem.-Tech.;* **6**: No. 8, 317-325(Aug 1977). (In German).

The targets and methods of modern coal gasification are illustrated by the example of some processes now being developed in the FRG. First, properties dependent on and independent of the degree of carbonization are discussed, and the reactive power of the coal is dealt with. This is followed by an outline of the general principles of coal gasification. Under the heading 'new gasification technologies' the Texaco process, the high-temperature Winkler process, the VEW coal conversion process, and coal gasification with nuclear process heat are gone into.

**20869 New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts.** Schulz, H.; Zein el Deen, A. (Univ., Karlsruhe, Ger.). *Fuel Process. Technol.;* **1**: No. 1, 31-44(Aug 1977).

Organic oxygen compounds formed by catalytic carbon monoxide hydrogenation during the Fischer—Tropsch synthesis are of interest as possible main products to be synthesized for use as basic organic chemicals. They also attract attention as a complex mixture of byproducts, the knowledge of the exact composition of which might contribute to the understanding of the complicated set of surface reactions of the Fischer—Tropsch system. In this investigation, the homologous series of straight-chain and branched alcohols, ketones, and acids have been determined in products of carbon monoxide hydrogenation through the processes of medium-pressure iron fixed-bed and entrained-phase operation. Quantitative relationships could be found for the change of the amounts of the number of homologous series with carbon number as well as between the amounts of compounds belonging to different series. These interrelations allow generalization in the form of reaction schemes. In a second paper detailed mechanistic interpretation of these findings is given.

**20870 New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data.** Schulz, H.; Zein el Deen, A. (Univ., Karlsruhe, Ger.). *Fuel Process. Technol.;* **1**: No. 1, 45-56(Aug 1977).

The formation of aliphatic chains bonded to the catalyst surface and the possibility of desorption of these intermediates as paraffins, olefins, alcohols and other classes of compounds in the Fischer—Tropsch system of carbon monoxide hydrogenation has to be visualized as a highly specific and sophisticated situation of competitive chemisorption and reaction of a number of intermediates, reactants and products. A picture of the network of surface reactions is developed from detailed product composition data and their interrelation with experimental conditions, the general behavior of the metals which possess catalytic activity, from a great number of tracer experiments mainly performed in combination with radio gas chromatography and recognizing the knowledge about related but simpler systems as hydrogenolysis, olefin hydrogenation, olefin polymerization and olefin hydroformylation, which with the exception of hydrogenolysis, can work as homogeneous conversions also. It is anticipated that the better understanding of the individual reaction steps during the Fischer—Tropsch syntheses will be a valuable basis for new research activity in this field, which is predominantly concerned with the selective production of organic chemicals from synthesis gas.

**20871 Metallographic and chemical analyses of a plain carbon steel plate after long term service in a coal gasifier.** Fischer, J.R. (Rockwell International Corp., Los Angeles); de Angelis, R.J.; Hahn, O.J.; Gillis, P.P. *Fuel Process. Technol.;* **1**: No. 1, 65-87(Aug 1977).

The steel inner liner of a coal gasifier was examined. This liner had been directly exposed to a coal gasification reaction for 20 years. The microstructure was observed and the chemical composition analyzed as functions of position in the vessel. Evidence of corrosion, embrittlement, and carburization was sought. Although pronounced microstructural variations were observed in this steel liner, the chemical composition was found to be quite uniform.

**20872 Factors affecting the corrosion of fusion-welded joints in coal gasification systems.** Bangs, E.R.; Beal, R.E.; Frankel, H.E. pp 185-205 of In Fabrication and reliability of welded process plant. Volume I. Cambridge, England; Welding Institute (1977).

From Conference on fabrication and reliability of welded process plant; London, UK (16 Nov 1976).

See CONF-761191—.

The initial alloys evaluated were selected on the following basis: Commercial availability, alloy group representation, alloys that have been used in the process industry, and alloys with composition ranges which permit estimation of the effects of different amounts of alloying elements like Ni, Cr, Al, and Si. Weld joint filler metals were selected on the basis of those recommended by the parent material manufacturer. It was concluded that: A minimum of 20% chromium is required for reasonable corrosion resistance; nickel-base alloys containing 15 to 20% chromium have relatively poor corrosion resistance compared to iron-base alloys containing 15 to 20% chromium and nickel contents of less than 35%; the nickel-base filler metal wire IN-82 has superior corrosion resistance to the covered electrode IN-182 (this may be accredited to the higher chromium content 18 to 22% v. 13 to 17%); temperature has a greater effect on corrosion than time at temperature; the 50Cr--50Ni alloy showed the best corrosion resistance; and generally, weld deposit fusion zones corroded at a faster rate than parent material or HAZs.

**20873 Note on underground coal gasification.** Boudet, E. *Ind. Miner., Mine;* No. 5, 230-232(1976).

Decribes the tests on underground gasification carried out by USBM at Hanna, Wyoming, using hydraulic fracturing of a 3m thick seam. The permeability of the seam was augmented by the fracturing. The process used successively direct combustion (the combustion front moves in the same direction as the gas) then inverse combustion. The average gas yield was 45,300 cu.m/day at 1222 kcal/cu.m.

## LIQUEFACTION

*REFER ALSO TO CITATION(S) 20849, 20859, 20860, 20912, 21388, 21924*

**20874** (BERC—0020-9) **Mass spectrometric analytical services and research activities to support coal-liquid characterization research. Quarterly report, June 9—September 30, 1977.** Scheppele, S.E. (Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry). 25 Oct 1977. Contract EY-76-S-02-0020. 14p. Dep. NTIS, PC A02/MF A01.

The purpose of this programming project is to assign automatically reasonable molecular formulas to experimental masses obtained from high-resolution mass spectra. The program developed reads experimental carbon-12 masses, converts them to corresponding Kendrick masses, and assigns a set of reasonable molecular formulas to each Kendrick mass within a given tolerance. The computational methods to do this are based on the tables previously developed by Guffey and Weber. The methods used to search these tables and generate the corresponding molecular formulas are discussed. This program is organized now so that it is resident on a disk pack on the IBM 370/158. Data entry may be from cards or from ket-to-disk data entry (TSO) terminal. This program is being used to process data acquired from the CEC 21-110B mass spectrometer. The development of this program will be continued to increase its analytical capabilities and to increase its ease of use. Acquisition of high-resolution mass spectral data for 12 fractions obtained from separation of a Canadian Tar Oil Sand sample has been continued.

**20875** (CONF-770814—10) **Riser cracking of coal to oil and gas.** Duncan, D.A.; Beeson, J.L.; Oberle, R.D. (Institute of Gas Technol-

ogy, Chicago, Ill. (USA)). 1977. Contract EX-76-C-01-1221. 8p. Dep. NTIS, PC A02/MF A01.

From American Chemical Society meeting; Chicago, IL, USA (29 Aug 1977).

Fifty percent of the carbon in the feed lignite can be converted to oils and gases at a system operating pressure of 2000 psig, a coil outlet temperature of from 1400° to 1500°F, and a residence time of approximately 2 seconds. Approximately 15% of the feed carbon reports as oils, and by choice of temperature and hydrogen dilution, some selectivity with respect to the constituents present in the make oil is possible. High operating temperatures and hydrogen dilutions tend to suppress the appearance of phenol, toluene, and xylene in the make oil. Some speculation can also be made regarding the actual product compositions, which will be more complicated than a slate of methane, ethane, BTX, and fuel oil. Significantly, no paraffins or naphthenes appear in the products so that it appears that most of the hydrogen consumed is used in methane formation and the stabilizing of free radicals.

**20876** (EPRI-AF—234) **Application of Lummus antisolvent deashing technology to a solvent refined coal solution. Final report.** Snell, G.J.; Simone, A.A. (Lummus Co., Bloomfield, N.J. (USA)). Sep 1976. 103p. Dep. NTIS, PC A06/MF A01.

Lummus antisolvent deashing technology is the preferred technically and economically viable alternative to rotary pressure precoat filtration when applied to the ash removal step of the Solvent Refined Coal (SRC) process. This is especially so when operability of the two systems are considered. Total deashing costs for antisolvent deashing are expected to be at least $1.37/Bbl SRC less than filtration deashing. Capital requirements associated with antisolvent deashing are significantly lower than those associated with filtration deashing. The relative economic incentives associated with antisolvent deashing would increase significantly if the operating reliability or on-stream time of the filtration deashing alternative were reduced from an optimistic base case value of 95% to 60 to 80%. In addition to the aforementioned relative economic advantages favoring antisolvent deashing, the recovered SRC product via antisolvent deashing can consistently provide a residual ash content of less than 0.1 wt.%.

**20877** (FE—1234-8) **Cresap Test Center inspection and acceptance services. R and D report No. 82, interim report No. 8.** O'Hara, J.B.; Hervey, G.H. (Parsons (Ralph M.) Co., Pasadena, Calif. (USA)). Sep 1977. Contract EX-76-C-01-1234. 444p. Dep. NTIS, PC A19/MF A01.

Parsons has completed the acceptance-inspection (A-I) service assignment for the Cresap pilot plant as described in modification No. 9 of Contract E (49-18)-1234. As a result of this work, a number of items requiring corrective action have been defined and are summarized in detail. When these corrections have been made, the pilot plant will conform to the engineer's design and specifications and will meet the requirements of all applicable codes; the one item that is excluded from this statement is the electrical system. Information available did not permit Parsons to review the incoming electrical service and the major distribution and grounding system. ERDA should review this portion of the facility following receipt from the engineer of basic design and installation information of the electrical system. Parsons also concludes that, upon correction of items listed in detail, the plant can be operated safely under operating conditions described by the engineer in training manuals. All required operating permits have been obtained and are valid. Conclusions regarding quality of workmanship and process or mechanical performance of the pilot plant are beyond the scope of this assignment.

**20878** (FE—2011-9) **Catalysts for upgrading coal-derived liquids. Quarterly report, June 9—September 8, 1977.** Crynes, B.L. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). 21 Sep 1977. Contract EX-76-C-01-2011. 57p. Dep. NTIS, PC A04/MF A01.

One experimental run was conducted to assess a composite feedstock (a mixture of equal volumes of raw anthracene oil and Synthoil II liquid). The reactor was prematurely shut down at the end of 185 hours due to plugging. At the Catalyst Life Test Unit ten experimental runs have been conducted, two of which are still continuing. Rasyn oil, a mixture of equal volumes of raw anthracene oil and Synthoil II liquid has been used as the feedstock. Rasyn oil has been successfully hydrotreated at 700°F (371°C), 1500 psig and for volume hourly space times of 1.25 and 2.5 hours for 674 and 501 hours of oil-catalyst contact. Experimental run series at temperatures of 750°F (399°C) has resulted in premature shut down due to reactor plugging. Relatively stable sulfur removal activity has been observed during the 176 hours of Synthoil II liquid hydrotreatment operation. In the case of Rasyn oil the hydrodesulfurization activity at 700°F (371°C), 1500 psig and 1.25 LVHST seems to decrease after 400 hours of operation. Significant hydrodenitrogenation activity decay has been observed in hydrotreating Synthoil II liquid as well as Rasyn oil. The CLTU computer is now monitoring the Catalyst Life Test Unit on a continuous basis and is recording the temperature and pressure profiles every hour. The molecular weight range for the principal compound types present in the asphaltene neutrals isolated from COED coal liquid was reinvestigated. The new data substantiate a considerably broader carbon number distribution for most of the Z and Z(0) series.

**20879** (IS—4310) **Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976—30 September 1977.** Woods, C.M.; Scott, T.E. (Ames Lab., Iowa (USA)). 15 Oct 1977. Contract W-7405-ENG-82. 57p. Dep. NTIS, PC A04/MF A01.

ASTM mechanical property specification verification tests have been conducted on the 2 1/4 Cr—1 Mo steel. The base properties have been determined for the steel at various temperatures and after exposure to various environments. Compression load versus deflection calibration curves have been determined for 316 SS loading rings. Thermal expansivity of both the 2 1/4 Cr—1 Mo steel and 316 SS have been determined at 500°F and 900°F. Thermal expansion characteristics and time dependence of the deflection of ring-sample composites have been measured to provide information about the constancy of stress on samples loaded by pre-compressed rings. Results of all exposure tests, including samples under load during exposure, in inert gas reveal that no degradation of ambient temperature mechanical properties occurs.

**20880** (IS—4311) **Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April—30 June 1977.** Woods, C.M.; Scott, T.E. (Ames Lab., Iowa (USA)). 15 Jul 1977. Contract W-7405-ENG-82. 37p. Dep. NTIS, PC A03/MF A01.

ASTM mechanical property specification verification tests have been conducted on the 2 1/4 Cr—1 Mo steel. The base properties have been determined for the steel and calibrations on the thermal expansivity of both the 2 1/4 Cr—1 Mo steel and 316 SS for use as loading rings have been completed.

**20881** **Catalytic activities and selectivities of $MoO_3$—$NiSO_4$ supported on various oxides for hydrocracking of solvent refined lignite. Novel low surface area active catalysts.** Ralston, D.; Govek, M.; Graf, C.; Jones, D.S.; Tanabe, K.; Klabunde, K.J.; Woolsey, N.F.; Baltisberger, R.J.; Stenberg, V.I. (Univ. of North Dakota, Grand Forks). *Fuel Process. Technol.;* **1**: No. 2, 143-150(Jan 1978).

The hydrocracking of solvent refined lignite (SRL) was studied over $MoO_3$—$NiSO_4$ catalysts supported on $TiO_2$, $ZrO_2$, $TiO_2$—$SiO_2$ and three kinds of aluminas at 450°C under an initial pressure of 2500 psi hydrogen. $MoO_3$—$NiSO_4$ supported on a fibrous alumina, $Al_2O_3$(FF), was found to show the highest activity, the total conversion of SRL being 92%. The activities per unit surface area of the catalysts supported on $TiO_2$ and $ZrO_2$ were much higher than those of other catalysts. A presulfided $MoO_3$—$NiSO_4$—$Al_2O_3$(FF) gave the largest amount of total liquid fractions. The best catalysts for the formation of gasoline fractions were presulfided $MoO_3$—$NiSO_4$—$Al_2O_3$(FF) and a commercially available catalyst, $MoO_3$—NiO—$Al_2O_3$(HT-100), which was also presulfided. It was shown that there is no correlation between acidic properties of the catalysts and their activities or selectivities.

**20882** **Recovery of zinc chloride catalyst from coal hydrogenation char.** Hill, A.H.; Wood, R.E.; Wiser, W.H. (Univ. of Utah, Salt Lake City). *Fuel Process. Technol.;* **1**: No. 2, 151-165(Jan 1978).

In the catalytic liquefaction of coal using zinc chloride, the recovery of the various spent zinc products is a prime requirement if the process is to be economically feasible. After hydrogenation, depending on the extent of coal conversion to liquid and gaseous products, about one third of the applied zinc is found with the liquids and two thirds remain with the char. The zinc associated with the liquid product is readily recovered with a water wash. The zinc associated with the char can be recovered by means of water and hydrochloric acid leaches to the extent of 70% of that present. The remaining char associated zinc (15 to 20% of that originally applied to the coal) is incorporated within the organic matrix of the char. A room temperature concentrated nitric acid leach is required to liberate the remaining zinc from the char. Ultimate recoveries of 98.5 to 99.7% are possible with the combined water, hydrochloric acid and nitric acid leach sequence.

**20883** **Early coal hydrogenation catalysis.** Donath, E.E.; Hoering, M. *Fuel Process. Technol.;* **1**: No. 1, 3-20(Aug 1977).

A description is given of the discovery of sulfur resistant catalysts and their use in hydrogenating coal to produce liquid fuels. The topics reviewed are the initial process development, catalyst development for the liquid phase hydrogenation, catalyst development for the vapor phase, and the use of the catalysts developed in the petroleum refining industry. (JSR)

**20884** **Coal liquefaction and desulfurization, utilizing synthesis gas.** Fu, Y.C. (to Energy Research and Development Administration). German(FRG) Patent 2,613,122/A/. 14 Oct 1976. 16p. (In German).

Well-known methods of coal liquefaction and desulfurization require or prefer a gas without CO because in most cases, the

catalyzer used is sensitive to CO, thus requiring the use of well-purified hydrogen which in turn is rather expensive. In contrast, on the present method inexpensive synthesis gas can be used containing a lot of CO. Here, coal is liquefied and desulfurized under increased pressure of a catalyzer by means of treatment gas consisting of hydrogen, CO and steam. The temperatures used range between 375-475°C, and the pressure to be applied ranges between 1,500 and 5,000 psig. For the slurrying of coal, any organic liquid can be used which is stabile under working conditions, or hydrocarbon liquids as i.e. tar, green oil, heavy petroleum oil, or production oil. The catalyzer consists of cobalt molybdate, which can also have a stabilizing effect on silicon, or nickel molybdate on aluminium oxide carriers, in most cases with an additional alkali-metal catalyzer such as, ergo, alkaline-carbonate, -formate, -acetate, -oxalate etc. Some examples are given with precise product analyses.

### SOLVENT EXTRACTION

**20885** **Solvolysis extraction using quinoline and phenol resin as coal model.** Ouchi, K.; Hirota, A.; Itoh, H. (Hokkaido Univ., Sapporo). *Fuel Process. Technol.;* **1**: No. 1, 21-30(Aug 1977).

Phenol resin as coal model was extracted with quinoline at 420°C for 2 h. The insoluble part was only 2.7%. The soluble part was separated into 7 fractions and their ultimate analysis, molecular weight and NMR spectra were measured. Model structures were proposed for these fractions. The increase of nitrogen content and the identification of the presence of 2,2'-biquinoline in the product are explained by a solvolysis reaction of quinoline with the thermally decomposed radicals of phenol resin.

## BY-PRODUCTS

**20886** **Processing of coke furnace gas. Separation of naphthalene.** Ullrich, H. (Otto (C.) und Co. G.m.b.H., Bochum (Germany, F.R.)). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **30**: No. 6, 263-267(Jun 1977). (In German).

The coke furnace gas contains 5 to 10 g naphthalene/$Nm^3$ clean gas. Subsequent to the discussion of the properties of naphthalene specially its solubility in water and tar oils its behaviour in recovery plants and gas pipes is considered. The fouling of the various plant parts particularly pipes and coolers by the sublimated product necessitates the naphthalene removal. Direct coolers with naphthalene extraction stage in the cooling water circuit as well as oil scrubbing are particularly suited. Some of the major aspects of the procedure are discussed.

## PROPERTIES

*REFER ALSO TO CITATION(S) 20844, 20850, 20916, 20920, 21919, 21921, 21922, 21923*

**20887** (CONF-771072—3) **Neutron induced gamma spectrometry for on-line compositional analysis in coal conversion and fluidized-bed combustion plants.** Herzenberg, C.L.; O'Fallon, N.M.; Yarlagadda, B.S.; Doering, R.W.; Cohn, C.E.; Porges, K.G.; Duffey, D. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 14p. Dep. NTIS, PC A02/MF A01.

From 3. international conference on nuclear methods in environmental and energy research; Columbia, MO, USA (10 Oct 1977).

Nuclear techniques involving relatively penetrating radiation may offer the possibility of non-invasive, continuous on-line instrumental monitoring which is representative of the full process stream. Prompt gamma rays following neutron capture are particularly attractive because the penetrating power of the neutrons and the, typically several MeV, capture gammas makes possible interrogation of material within a pipe. We are evaluating neutron capture gamma techniques for this application, both for elemental composition monitoring and for mass-flow measurement purposes, and this paper will present some recent work on composition analysis by neutron induced gamma spectrometry.

**20888** (COO—2898-10) **Material balance in coal. 2. Oxygen determination and stoichiometry of 33 coals.** Volborth, A.; Miller, G.E.; Garner, C.K.; Jerabek, P.A. (North Dakota State Univ., Fargo (USA). Dept. of Chemistry). 20 Jul 1977. Contract EY-76-S-02-2898. 24p. Dep. NTIS, PC A02/MF A01.

The chemical analysis of coal can be supplemented by the determination of oxygen in high and low temperature ash, in coal as received and in coal dried at 105°C. The rapid method utilizes fast-neutron activation. The reaction $^{16}O(n,p)^{16}N$ and counting of the 6.1 and 7.1 MeV gammas of 7.3 second half-life are used. A specially designed dual transfer and simultaneous counting system gives very accurate results. Oxygen in 33 coals ranging from lignite to low volatile bituminous coal is determined and compared with "oxygen by difference." Considerable discrepancies are observed. Better stoichiometric results are obtained if oxygen in coal ash, in wet coal and in the dried coal is determined. This permits the estimation of the true material balances using data of the ultimate and the proximate coal analysis. The oxygen determination provides the coal chemist with an accurate basis and can be used to rank coal. The summation of the percent of carbon, nitrogen, hydrogen, sulfur, and oxygen becomes more meaningful and some errors can be detected and the state of completeness of coal analysis thus evaluated. Total sulfur can be estimated and oxidation effects during drying can be detected. These affect the moisture determination. It appears that after more data are collected, the interpretation of solid fuel analyses may be facilitated and will be stoichiometrically more meaningful. It is shown that it may be possible to simplify the present time-consuming methods of coal analysis.

**20889** (FE—2030-8) **Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April—June 1977.** Spackman, W.; Davis, A.; Walker, P.L.; Lovell, H.L.; Essenhigh, R.H.; Vastola, F.J.; Given, P.H. (Pennsylvania State Univ., University Park (USA). Coal Research Section). Dec 1977. Contract EX-76-C-01-2030. 40p. Dep. NTIS, PC A03/MF A01.

One hundred and twelve coal samples have been added to the Penn State/ERDA Coal Sample Bank. One hundred and sixty-one sets of analytical data and 45 coal samples were provided upon request to other agencies engaged in coal research. Construction of the pressurized laminar flow isothermal reactor is complete and delivery has been made. Rapid heating of the precursor coal has been found to enhance char reactivity in the case of a North Dakota lignite. The differential scanning calorimetry technique has been used to determine the heat of chemisorption of oxygen on an activated Saran carbon.

**20890** (FE—2205-7) **Chemical equilibrium in ash-laden coal combustion systems.** Desrosiers, R.E. (New Hampshire Univ., Durham (USA). Dept. of Chemical Engineering). 18 May 1977. Contract EX-76-C-01-2205. 12p. Dep. NTIS, PC A02/MF A01.

A computer program has been developed to calculate vapor-liquid equilibria in ash-ladem systems. Activity coefficient data for the metal oxide components of coal slags are tabulated. The calculated equilibrium vapor concentrations of species capable of transporting Si, Al, Fe, Ca, Mg, Na and K are reported as functions of temperature at 6% and 35% of stoichiometric oxygen.

**20891** (FE—5065-2) **Prediction model for compositional changes within a coal from core data. Quarterly report, September—December 1976.** Renton, J.J.; Donaldson, A.C.; Ting, F.T.C. (West Virginia Univ., Morgantown (USA). Dept. of Geology). 15 Jan 1977. Contract EY-76-S-05-5065. 21p. Dep. NTIS, PC A02/MF A01.

The Waynesburg coal has been sampled on a within-a-mine basis with 23 sections each with the coal sampled at 6 inch increments excluding partings for a total of 347 samples. In addition, two grid samplings were taken on the top of the bottom bench of 30 samples each; one grid on a 1 meter grid interval and the other on a 3 meter grid interval. All samples are subjected to moisture, volatiles, high temperature ash, B.T.U., sulfur (total and species) and low temperature ash (LTA) determinations. The LTAs were analyzed by x-ray diffraction. In addition, 228 lithotype samples were collected; 44 from regional locations and 174 from three column locations. These samples, in addition to petrographic descriptions both megascopic and microscopic were subjected to the basis analyses listed above. A systematic study of pyrite in the Waynesburg coal was initiated with an optical microscopic and a scanning electric microscopic description of pyrite in LTA, whole coal samples, lithotypes and macerals. A classification scheme for the description of pyrite types was established. The application of a combined pyrolytic-chromatographic technique was used to analyze the basic organic make up of a whole coal, lithotype and maceral samples. These data will be correlated with the previous petrographic and inorganic data.

**20892** (FE/2692—1) **Coal minerals bibliography. Quarterly report No. 1, June 15—September 15, 1977.** Akers, D.J.; McMillan, B.G. (West Virginia Univ., Morgantown (USA). Coal Research Bureau). Sep 1977. Contract EF-77-S-01-2692. 11p. Dep. NTIS, PC A02/MF A01.

The initial work on this project involved the investigation of the various computer information retrieval services. After consideration of the available electronic retrieval services, the following four were selected: GEOREF, CHEMCON, Engineering Index and RECON. Although a number of useful references were obtained from these computer searches (a total of 163 from all four), it was determined that it was not possible to perform a thorough literature search using only computer retrieval services. The main problem encountered with these systems was lack of depth. Older references are often not listed. Also, the method of classification of articles used by these systems is generally based on the exact verbiage used in the reference rather than on the general concepts or techniques under discussion. Accordingly, it will be necessary to supplement the

computer searches with an extensive manual search of the available literature. The two largest data bases, which will be covered manually, are Chemical Abstracts and Engineering Index. Additional abstracting services such as the Index of Geology will be considered and the list of publications from various state geologic surveys will be examined. The main emphasis during this report period has been placed on the Engineering Index, which has been completley manually searched. One problem which has been encountered frequently is that translations of foreign references, especially those in Russian, are not usually available. Many valuable research articles on coal-minerals have been published in foreign journals; however, because of time, funding limitations and the language problem, they must be considered outside the scope of this project.

**20893 Separation of hydroaromatics and polycyclic aromatic hydrocarbons and determination of tetralin and naphthalene in coal-derived solvents.** Schabron, J.F.; Hurtubise, R.J.; Silver, H.F. (Univ. of Wyoming, Laramie). *Anal. Chem.;* **49**: No. 14, 2253-2260(Dec 1977).

Tetralin and naphthalene in a coal liquefaction recycle solvent were determined by high performance liquid chromatography (HPLC) with a μ-Bondapak $C_{18}$ stationary phase and a methanol:water mobile phase. Initially two fractions were collected from an aluminum oxide open column. The first fraction contained tetralin and the second naphthalene. The standard addition method was employed to determine tetralin and naphthalene. The standard deviation was 0.024% for tetralin and 0.035% for naphthalene. Several aromatic and hydroaromatic compounds were identified by their chromatographic behavior and by their fluorescence excitation and emission spectra. A correlation factor which relates the log k' values for polycyclic aromatic hydrocarbons (PAH), alkyl-substituted aromatic hydrocarbons, and hydroaromatics to certain structural features was developed. The results from this work show the possibility of developing an overall separation and characterization scheme for complex mixtures of aromatic and hydroaromatic compounds.

**20894 Nitrogen compounds in coal derived liquids.** Schiller, J.E. (Energy Research and Development Administration, Grand Forks, ND). *Anal. Chem.;* **49**: No. 14, 2292-2294(Dec 1977).

Five liquid products from different pilot plant scale coal liquefaction processes were examined. Column chromatography was used to isolate a fraction of each sample that contained the nitrogen compounds, and this fraction was subjected to gas chromatography-mass spectrometry (GC/MS), low voltage mass spectrometry, and high resolution mass spectrometry. The major compound types seen were quinolines, benzoquinolines, and carbazoles. Benzocarbazoles and compounds in the mass Z series -13 N (phenylpyridines, diphenylamines, and aminobiphenyls) were also major constituents in some liquids studied. The composition of the liquids reflected differences in process conditions. A broader range of compounds resulted from more vigorous liquefaction conditions (higher pressure, higher temperature, longer reaction time, or recycle).

**20895 Molecular weight and association of coal-derived asphaltenes.** Schwager, I.; Lee, W.C.; Yen, T.F. (Univ. of Southern California, Los Angeles). *Anal. Chem.;* **49**: No. 14, 2363-2365(Dec 1977).

The preliminary results obtained by studying Vapor Pressure Osmometry (VPO) molecular weights of coal-derived asphaltenes, and coal-derived asphaltene derivatives as a function of concentration in the solvents benzene and tetrahydrofuran are reported.

**20896 Study of the pyrolysis of toluene and phenols at low pressure.** Braekman-Danheux, C.; Delaunois, C.; Quyen, N.C. (Univ., Brussels). *Fuel Process. Technol.;* **1**: No. 1, 57-64(Aug 1977).

Pyrolyses of o-cresol, 2,4-xylenol and toluene have been carried out at $10^{-6}$ Torr. In addition to the products previously obtained in pyrolysis at atmospheric pressure and under high pressure, unexpected compounds, such as ketones from phenols and hydrogenated products from toluene, have been obtained. Possible reaction mechanisms are discussed.

**20897 Method and device for determining the sulfur content of coal.** Page, D. (to Coal Industry (Patents) Ltd.). German(FRG) Patent 2,607,968/A/. 30 Sep 1976. 13p. (In German).

Subject of the invention is a simple method for determining sulfur contents in coal, applicable immediately after the winning of coal and superior to usual chemical methods of analysis because of its speed. Essential is the fact that sulfur appears in organic, sulfatic, and pyrite forms. Finally, the knowledge of the iron content is important for the calculation of the total sulfur concentration. According to the new method, the coal sample is exposed to X-rays. Iron and sulfur atoms of the sample are excited to emit their respective fluorescence radiation. Their intensities are measured. Proportional counters, semi-conductor or lithium doted silicon detectors are used as detectors. If the iron contents of the sampe is known, a single-channeled measuring device equipped with one radiation source is sufficient. If, in contrast, the iron content is not known, a double-channeled measuring device with two sources of radiation is necessary. The sulfur content can be displayed directly by means of respective data processing and calibration sampling. Radioactive isotopes, X-ray tubes or sources of bremsstrahlung may be used.

**20898 Optimum conditions for the fractional analysis of <1 mm coal samples.** Kipnis, Sh.Sh.; Karazinova, K.G.; Shapiro, M.M. *Coke Chem., USSR (Engl. Transl.);* No. 8, 11-13(1976).

Translated from Koks Khim.; No. 8, 8-10(1976).

A report is presented on research to determine the optimum separation conditions for <1, <0.1 and 1 to 0.1 mm coal samples. The findings are embodied in the revised standard GOST 4790-75.

## WASTE MANAGEMENT

*REFER ALSO TO CITATION(S) 20890*

**20899** (EPRI-FP—291(Vol.1)) **Development program for an ionizer—precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report.** Schwab, J.; Goodson, D.; Cooper, J.; Ehlenberger, R.; Milovsoroff, P. (Air Pollution Systems, Inc., Seattle, Wash. (USA)). Oct 1976. 42p. Dep. NTIS, PC A03/MF A01.

This work was directed at developing more effective electrostatic precipitation of fine particulate, particularly of high resistivity fly ash, by imposing a higher degree of charge on the particles. A unique electrode assembly results in an intensely ionized flue gas which leads to a particle charge as high as four times greater than is currently being achieved. Such an ionizer would be the first or charging stage of an improved two-stage power station electrostatic precipitator immunized against high resistivity dust. Economic evaluations of the concept based on laboratory data are included. The evaluations indicate potential cost savings on new systems and retrofit upgrades. Possible mechanical arrangements for incorporating the high intensity ionizer into conventional design precipitators are indicated for both new and retrofit installations. Small scale field pilot work was undertaken at an operating utility to supplement laboratory work.

**20900** (EPRI-FP—291(Vol.2)) **Development program for an ionizer—precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report.** Schwab, J.; Goodson, D.; Cooper, J.; Ehlenberger, R.; Milovsoroff, P. (Air Pollution Systems, Inc., Seattle, Wash. (USA)). Oct 1976. 357p. Dep. NTIS, PC A12/MF A01.

This work was directed at developing more effective electrostatic precipitation of fine particulate, particularly of high resistivity fly ash, by imposing a higher degree of charge on the particles. A unique electrode assembly results in an intensely ionized flue gas which leads to particle charge as high as four times greater than is currently being achieved. Such an ionizer would be the first or charging stage of an improved two-stage power station electrostatic precipitator immunized against high resistivity dust. Economic evaluations of the concept based on laboratory data are included. The evaluations indicate potential cost savings on new systems and retrofit upgrades. Possible mechanical arrangements for incorporating the high intensity ionizer into conventional design precipitators are indicated for both new and retrofit installations. Small scale field pilot work was undertaken at an operating utility to supplement laboratory work.

**20901** (FE—2205-8) **Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977—July 31, 1977.** Ulrich, G.D. (New Hampshire Univ., Durham (USA). Dept. of Chemical Engineering). 24 Aug 1977. Contract EX-76-C-01-2205. 10p. Dep. NTIS, PC A02/MF A01.

Portions of document are illegible.

Laboratory investigation of growing silica particles has been completed, and titania is scheduled for study beginning in September. Preliminary sampling continues at Merrimack boiler No. 2. A satisfactory probe has been developed and chemical analysis techniques have been established for quantitative fly-ash analysis. The program for computing condensed-phase equilibria is ready for use in a theoretical analysis. Activities to develop a model for submicron fly-ash formation and growth have begun. Two manuscripts concerning sub-micron particle growth and the effect of such particles on boiler performance have been scheduled for publication. A third is being prepared.

**20902** (FE—2579-10) **Granular bed filter development program: particle sampling facility operation.** Phillips, K.E. (Combustion Power Co., Inc., Menlo Park, Calif. (USA)). Oct 1977. Contract EF-77-C-01-2579. 56p. Dep. NTIS, PC A04/MF A01.

This report presents details regarding CPC's particle sampling techniques and procedures. It is shown that EPA Method 5 loading results check within 3% of other discrete sample techniques and within 9% of loadings calculated from an overall test material

balance. Size distribution measurements using the Andersen 2000 Mark III impaction classifier are shown to compare favorably with University of Washington impaction classifier results obtained by an independent sampling team and are of the same order as manufacturer's data obtained using a scanning electron microscope. An outline of interface procedures with the outside sampling subcontractor is included.

**20903** (IS-T—777) **Aluminum recovery from coal fly ash by high temperature chlorination.** Wijatno, H. (Ames Lab., Iowa (USA)). Oct 1977. Contract W-7405-ENG-82. 88p. Dep. NTIS, PC A05/MF A01.

Thesis.

A study of aluminum recovery from power plant fly ash by high temperature chlorination was undertaken to demonstrate that fly ash could be a potential source of aluminum, iron and possibly silicon. Magnetic separation of the iron oxide served as a first step to alleviate the iron contamination problem. However, the agglomeration of some iron oxide with alumina and silica made it difficult to completely separate the iron from the fly ash. Further iron separation was achieved by chlorinating the nonmagnetic ash fraction at 550°C for 30 minutes. This reduced the iron oxide content to less than 4 percent by weight. Chlorine flow rates affected the reaction rate much more drastically than temperatures. This suggested that diffusion was the major rate-controlling step. Besides $Fe_2O_3$, $Al_2O_3$ and $SiO_2$, other oxides such as CaO, $K_2O$, $Na_2O$ and MgO might have complicated the alumina recovery by forming individual chlorides or complexes. Investigating methods for separating more $Fe_2O_3$, and possibly CaO, $K_2O$, $Na_2O$ and MgO from the nonmagnetic ash fraction before chlorinating it is highly recommended.

**20904** (PERC/RI—77/13) **Treatability studies of condensate water from Synthane coal gasification.** Johnson, G.E.; Neufeld, R.D.; Drummond, C.J.; Strakey, J.P.; Haynes, W.P.; Mack, J.D.; Valiknac, T.J. (Department of Energy, Pittsburgh, Pa. (USA). Pittsburgh Energy Research Center). Nov 1977. 31p. Dep. NTIS, PC A03/MF A01.

Bench-scale treatment tests consisting of oil and grease removal, biological oxidation and adsorption with by-product char were conducted on condensate water from the gasification of Montana and Illinois coals in the Synthane process development units. Test data from each of the treatment steps are presented, indicating that a single treatment step will not adequately clean the water and that several consecutive treatment steps will be required. Overall removals of 99.9% phenol and 97% TOC (total organic carbon) were obtained by the treatments used.

**20905** **Present relationships of sulfuric acid concentration to acid dewpoint for flue gases.** Cheney, J.L. (Environmental Protection Agency, Research Triangle Park, NC); Fortune, C.R. *Anal. Lett.;* **10**: No. 10, 797-816(1977).

Interpretation of flue gas acid dewpoints in terms of sulfuric acid concentrations has relied heavily upon Muller's work. A more recent work by additional authors indicates disagreement with Muller's curves. This work involves the study of the acid dewpoint-acid concentration relationship using a commercially available acid dewpoint meter. The study involves generating a steady-state, high-temperature, sulfuric acid gas stream using a newly designed acid generation system. By using an absorption reference method, dewpoint as a function of acid concentration and moisture are compared with previous authors. The relationship established is then used along with the previous works to interpret some actual flue gas dewpoints to simultaneous flue gas acid measurements.

**20906** **Process for the removal of nitrogen oxides from flue gas.** Hishinuma, Y.; Akimoto, H.; Kaji, R.; Nakajima, F.; Arikawa, Y. (to Hitachi Ltd. ). German(FRG) Patent 2,613,417/A/. 21 Oct 1976. 15p. (In German).

A process is described where the removal of nitrogen oxides, particularly nitrous oxide from flue gas takes place using a wet method. In contrast to previous processes, where nitrogen oxides are absorbed or oxidised, the nitrogen oxide is first oxidised and then absorbed in one step here. For this purpose the flue gas, which either contains oxygen naturally, or has oxygen artificially added to it, is brought into contact with a solution of transition metal compounds. These compounds first react with the oxygen to form oxygen compounds, with which the nitrogen oxides are oxidised. In a second stage, the oxidised nitrogen oxides are absorbed by the transition metal compounds and transformed into new nitrogen oxide compounds. Bivalent cobalt, monovalent copper or chromium are used as the transition metal ions in the compounds. Ammonia, amines, particularly ethylamine or imidazol derivatives, particularly histidine are described as effective ligands. About 90-95% of the nitrogen oxides are removed by the method illustrated by examples.

**20907** **Process for separation of nitrogen oxides from waste gas.** Senjo, T.; Kobayashi, M. (to Fuji Kasui Engineering Co. Ltd.). German(FRG) Patent 2,600,034/A/. 8 Jul 1976. 17p. (In German).

The present process for the separation of nitrogen oxides from waste gases is characterised by the fact that it circumvents the slowness to react of certain nitrogen oxides, particularly nitrous oxide, in direct separation processes. To achieve this, a strong oxydant, preferably chlorine dioxide or ozone is added to the waste gas in stoichiometric quantities to promote oxidation, which produces nitric oxide. The subsequent stage of the process corresponds to the usual process: The gas mixture is now washed with an aqueous washing solution to remove the nitrogen oxides, the solution containing a sulphur reduction compound of alkaline metals or of ammonia and smaller quantities of a catalytic compound. The catalyst has a double function here. On the one hand it accelerates the reduction of nitrogen oxides and therefore their removal from the waste gas. On the other hand it slows down the oxidation of the sulphur compounds to be reduced by the oxygen, which is often present in waste gases. The catalyst is an organic amino- or nitrogen-compound or an oxidation or reduction derivative of these. The sulphur containing reduction compounds are preferably sulphites, sulphides, thiosulphates etc. Various examples are given with modified conditions.

**20908** **Process for the treatment of flue and waste gases.** Hisamasu, T.; Kitamura, T.; Saito, T.; Takagi, H.; Sekiya, T.; Kurashiki, O. (to Asahi Kasei Kogyo K.K.). German(FRG) Patent 2,557,560/A/. 24 Jun 1976. 35p. (In German).

The cleaning of flue and waste gases is necessary, as the sulphur dioxide and nitrogen oxides (contained in them) have deleterious effects on the atmosphere. In this, the removal of nitrogen oxides in particular is a technical problem. A process is described here, which removes sulphur dioxide and nitrogen oxide simultaneously from these waste gases. An aqueous solution is used as the washing- and absorption solution, which contains sulphites, iron ions and aminopoly-carbonic acid in certain quantities. This solution is added to the flue or waste gas at a temperature of 40 - 100°C, where the latter contains sulphur dioxide and nitrogen oxide, in an absorption zone. After successful absorption the solution is kept in a reduction zone at the same temperature for 1 - 30 minutes, where contact with the flue or waste gas is interrupted. In such conditions of the process the sulphur dioxide reacts to form dithionate and the nitrogen oxides are reduced to nitrogen. Schematic circuit diagrams are provided, which show how such a plant can operate continuously, where, above all, the absorption solution circulates in a loop. Apart from this, several variants are shown, where different sulphites, iron salts and aminopoly-carbonic acids are used.

**20909** **Method of removing sulfur dioxide from a gas.** Nicholson, N.E.; Scarlett, J. (to Davy Powergas Ltd.). German(FRG) Patent 2,555,815/A/. 16 Jun 1976. 43p. (In German).

A method is described using an absorption-desorption cycle for the removal of sulfur dioxide from exhaust gases. Here, essentially aqueous sodium sulfite is used. The special advantage of this method is the fact that undesired by-products, i.e. sodium sulfate and sodium-thio-sulfate are chemically reduced in a seperate process. The reduction product occuring consists of sodium carbonate and sodium bicarbonate, furthermore of sodium-hydrogen sulfite. The reducing atmosphere is created by combusting a fluid fuel with an amount of oxygen being interstoichiometric for complete combustion. The solution contacted and chemically reduced is tempered and becomes an aqueous, liquid product, which is finally carbonated. After condensing the solution to a prescribed amount of Na salts, the product is conducted again into the absorption-desorption system. By means of this backflow not only undesired by-products are avoided, but also the sodium losses usually occuring are restricted to a minimum. The method corresponding to the invention is explained by means of examples, particularly in view of the concentration range of solution components.

## ENVIRONMENTAL ASPECTS

*REFER ALSO TO CITATION(S) 20935, 21717, 22151, 22152, 22276*

**20910** (CONF-770658—, pp 87-98) **Environmental overview.** Ayres, R.E. (Natural Resources Defense Council, Washington, DC). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

The environmental effects of coil use in industrial boilers are discussed. Sulfur oxides emissions are examined along with concerns of increased acidity in rainfall and increased nitrogen oxides emissions. The technology of flue gas cleanup is briefly discussed. (JRD)

**20911** (CONF-7710101—4) **Environmental control technology program studies at Argonne National Laboratory: surface mine effluents.** Bogner, J.E.; Johnson, D.O. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 10p. Dep. NTIS, PC A02/MF A01.

From 5. national conference on energy and the environment; Cincinnati, OH, USA (31 Oct 1977).

The chemical quality of surface waters in areas characterized by coal strip mining is the result of both local and regional factors, including composition of coal, overburden, and underclay; mobility of selected chemical constituents in rocks, sediments, and minesoils; activity of chemoautotrophic bacteria; mining and reclamation methods and equipment; density of mining operations in a given watershed; seasonal fluctuations in regional stream discharges; and control technologies implemented to treat mine effluents. The major problems associated with mine effluents in the eastern region are acid mine drainage, generated by the oxidation and subsequent hydrolysis of iron disulfide minerals, and high concentrations of dissolved metals and suspended solids. Control technologies commonly utilized to ameliorate these problems include (1) the addition of alkaline reagents such as hydrated lime, soda ash, or sodium hydroxide to neutralize the acid and promote the precipitation of dissolved metals; and (2) the construction of settling ponds to promote the sedimentation of suspended solids.

**20912** (ERDA—1547(Vol.2)) **Alternative Fuels Demonstration Program. Final environmental impact statement.** (Energy Research and Development Administration, Washington, D.C. (USA)). Sep 1977. 362p. Dep. NTIS, PC A10/MF E01.

Vol. 2 consists mainly of (1) Alternatives to the proposed demonstration plant program, including environmental trade-off possibilities, and (2) a discussion of comments (and the responses) received on the draft environmental statement. Five appendices are devoted to: Synthetic fuel processes, air emissions calculations, solid waste calculations, long term scenarios and comment letters. (LTN)

**20913** (PB—269568) **Water conservation and pollution control in coal conversion processes. Final report June 1975—December 1976.** Goldstein, D.J.; Yung, D. (Water Purification Associates, Cambridge, Mass. (USA)). Jun 1977. Contract EPA-68-03-2207. 486p. NTIS PC A21/MF A01.

The report gives results of a study to determine water consumption and environmental impacts of coal conversion processes in Western states. Part 1 gives brief descriptions and process water requirements for nine conversion processes. Detailed designs and analyses are given for the Hygas, Synthane, and Solvent Refined Coal (SRC) processes, and for Lurgi combined-cycle power generation. At three proposed sites (in North Dakota, New Mexico, and Wyoming), complete water requirements and effluents, including all mining and related off-site uses, are given for the power, Hygas, and SRC plants. The Synthane process is analyzed only at the Wyoming site. Part 2 gives analyses of influent and effluent waters, with examples for study. For the three selected plants at the North Dakota site, source water of good quality is assumed to be cheap and available. For three plants in New Mexico, source water will be available but is brackish. All the plants at the Wyoming site receive sewage from a satellite town; additional fresh water is available but is assumed to be expensive. For each process at each site (10 cases) an integrated water treatment plant block flow diagram is given with approximate costs and energy requirements.

**20914** (RLO/2228/T003—2) **Establishment, succession, and stability of vegetation on surface mined lands in eastern Montana. Annual progress report, June 1, 1975—February 29, 1976.** Sindelar, B.W. (Montana State Univ., Bozeman (USA)). Mar 1976. Contract EY-76-S-06-2228-003. 17p. Dep. NTIS, PC A02/MF A01.

An ecological investigation of reclamation and plant succession on stripmined lands near Colstrip, Montana, was initiated in July, 1975. The purpose of the study is to investigate and document the permanence and stability of plant communities established on lands mined since 1923. Nine fenced exclosures on 1 to 8 year old reclamation plantings and on 44 to 53 year old naturally revegetated coal spoils were established in the fall of 1975. Initial plant species lists and plant collections were prepared at each site. Transects were set up within the exclosures for analyses of a number of plant population parameters. A variety of equipment and materials for sampling was acquired. A review of pertinant literature was begun.

## RESERVES AND EXPLORATION

*REFER ALSO TO CITATION(S) 21116*

**20915** **Mineral exploration and mining in Brasil--1977.** Schiller, E.A. *Min. Mag.;* **137**: No. 3, 245-252(Sep 1977).

A survey is presented of current mineral exploration and mining activity in Brazil, a country long thought to have vast mineral potential. The Brazilian exploration of the 1970's appears to be petering out and, unless some major discoveries are made, the foreign companies undertaking much of this work may reduce or terminate their Brazilian programs. Various mining sectors examined include those producing iron ore, manganese, bauxite, uranium, copper, tungsten, and coal.

## MINING

*REFER ALSO TO CITATION(S) 20911, 20914, 20932, 20934, 20942, 21697*

**20916** (FE—1231-9) **Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April—June 1977.** Haycocks, C.; Townsend, J.M.; Neall, G.M.; Johnson, L.P. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering). Dec 1977. Contract EX-76-C-01-1231. 52p. Dep. NTIS $5.25.

Research in areas related to coal mining was continued. Computer programs related to longwall mining were developed and tested. The work of sampling and testing of coal specimens continued, especially with respect to the effects of size and shape (cylinder vs cube) of the specimens on the measured properties. In addition, loading rate appears to be of some significance. The literature of supports in underground mining has been reviewed, especially with respect to roof bolts and roof trusses. The testing of functional plastic models of roof trusses by photoelastic methods has been continued. Monitoring of instrumented roof trusses in Alabama has been continued. (LTN)

**20917** (PB—269914) **Coal recovery from bituminous coal surface mines in the eastern United States: a survey. Information circular.** Secor, E.S.; Larwood, G.M.; Gupta, A.B.; Lees, A.S. (Bureau of Mines, Pittsburgh, Pa. (USA). Eastern Field Operation Center). 1977. 20p. (BM-IC—8738). NTIS PC A02/MF A01.

The Federal Bureau of Mines conducted a field survey of 153 bituminous coal strip and auger mines to estimate coal recovery from surface mines in the Eastern United States. Recovery was calculated from field data by measuring coal losses resulting from mining coal and leaving barriers. Mean total coal recovery varied only slightly for the two regions studied; 82.7 percent for Appalachia and 84.3 for the Midwest. Total recovery grouped by mining method--contour, area, and mountaintop removal--was 79.8, 84.7, and 85.3 percent, respectively. Mean auger recovery was 35.9 percent; of the total average loss of 64.1 percent, over one-half resulted from design limitations while the remainder was attributed to operating losses. The wide recovery range at individual mines indicate the variability of the eastern surface coal mining industry. Because of this, care should be exercised in applying the results of this report to reserve estimates other than those of a general nature.

## TRANSPORT AND HANDLING

*REFER ALSO TO CITATION(S) 20842, 20931, 21484*

**20918** (BM-RI—8262) **Desulfurization of various midwestern coals by flotation.** Miller, K.J. (Bureau of Mines, Pittsburgh, Pa. (USA). Coal Preparation and Analysis Lab.). 1978. 13p. of Mines, Washington, DC.

Laboratory batch flotation tests were conducted to determine the viability of the Bureau of Mines coal-pyrite flotation process in desulfurizing various coals from the midwestern coalfields. Nine coals obtained from western Kentucky and Illinois were used in the study. In addition to the Bureau's coal-pyrite flotation process, some of the coals were subjected to two-stage rougher-cleaner coal flotation for comparison. The results of this work showed that up to a 70% pyritic sulfur reduction could be obtained by flotation and that the Bureau's coal-pyrite flotation was superior to rougher-cleaner coal flotation. Because many of the coals retained far too much sulfur even after second-stage flotation treatment, it was concluded that these midwestern coals are more difficult to desulfurize by flotation than are the Appalachian coals tested in earlier Bureau experiments.

**20919** **Determining the efficiency of p.f. preparation under conditions of varying load of a generating unit.** Gofaizen, A.V.; Gombolevskii, V.I. *Therm. Eng. (USSR) (Engl. Transl.);* **22**: No. 11, 66-68(Nov 1976).

Translated from Teploenergetika; 22: No. 11, 59-62(Nov 1975).

In recent years certain organizations have carried out work aimed at raising the efficiency of power generating units when starting up and under variable load conditions. For this purpose it is important to know the specific consumptions of power, heat and fuel per tonne of p.f. prepared, with the aid of which one can evaluate, depending on the load of the unit, the costs connected with the preparation of the p.f. and determine the economical conditions for operation of the plant. The results of the calculation lead us to recommend that, with a reduced power load, the mills should be run at rated output and that periodically at least one of them should be

shut down as a standby within practically the entire range of electrical loads of the unit. Based on the proposed method, similar problems can be solved for other power generating units with different layouts of p.f. preparation plant.

**20920 Quality characteristics and floatability of Pechora coals.** Elekhov, M.S. *Coke Chem., USSR (Engl. Transl.);* No. 8, 7-10(1976).

Translated from Koks Khim.; No. 8, 5-7(1976).

The Pechora coalfield is one of the world's most important, in terms of reserves and coal quality. It contains coals of every grade from brown to semi-anthracite. The commercially most valuable coals are the coking coal reserves, which amount to approximately 20% of the total and are a superior material for blast-furnace coke production. The Pechora coalfield is the most important source of materials for the coke and metallurgical industries in the USSR. From the flotation viewpoint, the genetics, composition, and properties of Pechora coals are distinctly different from those found elsewhere. The differences are particularly pronounced in the G and Zh grade coals which make up the greater part (> 80%) of the coking coal reserves. The differences extend to the physico-chemical properties of the coal surfaces and hence to their sorption and flotation behavior. The Pechora coals are unusually rich in oxygen, in the form of functional hydroxy groups on the particle surfaces. Flotation therefore entails an increased consumption of heteropolar reagents or the adoption of flotation reagents with high concentrations of heteropolar substances. Following research, recommendations have been issued for the reagent conditions required in the flotation of Pechora coals, in keeping with their specific qualitative properties.

**20921 Use of methylisobutylcarbinol for coal flotation.** Deberdeev, I.Kh.; Merkurova, M.S.; Volkov, L.A. *Coke Chem., USSR (Engl. Transl.);* No. 8, 14-16(1976).

Translated from Koks Khim.; No. 8, 10-12(1976).

Data are presented on coal flotation in the presence of MIBC (methylisobutyl-carbinol). Flotation conditions are proposed, whereby higher efficiency can be attained at much lower non-polar reagent consumptions than currently required; non-polar reagents may be completely unnecessary in certain cases.

## COMBUSTION

*REFER ALSO TO CITATION(S) 20889, 20890, 21464, 21496, 21752, 21753, 21754, 21807, 21808, 21809, 21810, 21811, 21812, 21861, 22084*

**20922** (ANL—77-14) **Analysis of the high-temperature particulate collection problem.** Razgaitis, R. (Argonne National Lab., Ill. (USA)). Oct 1977. Contract W-31-109-ENG-38. 138p. Dep. NTIS, PC A07/MF A01.

Particulate agglomeration and separation at high temperatures and pressures are examined, with particular emphasis on the unique features of the direct-cycle application of fluidized-bed combustion. The basic long-range mechanisms of aerosol separation are examined, and the effects of high temperature and high pressure on usable collection techniques are assessed. Primary emphasis is placed on those avenues that are not currently attracting widespread research. The high-temperature, particulate-collection problem is surveyed, together with the peculiar requirements associated with operation of turbines with particulate-bearing gas streams. 238 references.

**20923** (ANL/CTIU/FE—005) **Pressurized fluidized-bed combustion combustion test and integration unit, PFBC/CTIU project. ANL monthly progress report, October 1977.** Leffler, L. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 18p. Dep. NTIS, PC A02/MF A01.

Various features of the design of a pressurized fluidized-bed combustor are discussed. Project planning is described briefly, especially with respect to projected costs and manpower. (LTN)

**20924** (CONF-770658—) **Proceedings of the fuel switching forum.** (Mitre Corp., McLean, Va. (USA). METREK Div.). Nov 1977. 294p. Dep. NTIS, PC A13/MF A01.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

Papers were presented at the forum on coal firing, environmental effects of coal combustion, boiler conversion from oil to coal, coal and ash handling, coal supply and transport, and coal burning equipment. A separate abstract was prepared for each paper. (JRD)

**20925** (CONF-770658—, pp 29-52) **General Motors powdered coal-oil project.** Brown, A. Jr. (General Motors Corp., Warren, MO). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

The use of coal-in-oil fuel for steam generation is discussed. Results of demonstration plant operation showed that coal-oil slurries perform as well as residual grade fuel oil using conventional equipment. Data on test boiler operation are included along with data on ash analyses. (JRD)

**20926** (CONF-770658—, pp 69-86) **Pittsburgh Energy Research Center (PERC) combustion support program.** Bienstock, D. (Pittsburgh Energy Research Center). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Research programs concerned with coal-oil slurries are discussed. A 700 hP water-tube steam generating unit to burn coal-oil slurries and a 100 hP fire-tube steam generator are described using schematics. A coal-oil slurry combustion test facility is also described. Data from combustion tests are included along with information on retrofitting to burn coal-oil slurries in industrial oil-fired boilers. (JRD)

**20927** (FE—1511-39) **Pressurized fluidized bed combustion. Quarterly technical progress report, January—March 1977.** (National Research Development Corp., London (UK)). Apr 1977. Contract EX-76-C-01-1511. 90p. Dep. NTIS, PC A05/MF A01.

Tests are being carried out on the pressurized combustor at Leatherhead, England, to investigate the performance with a deep bed (8 ft) and tube bank. Two tests have been completed in the present quarter: Test 6: at a nominal fluidizing velocity of 2½ ft/s and excess air of 25 percent and 100 percent for 150 hours. Test 7: at a nominal fluidizing velocity of 7 ft/s and excess air of 90 and 60 percent for 100 hours. Full results for Test 6 are reported. Test 7 was completed at the end of the current quarter and only qualitative information is given. Operation with the deep bed and tube bank did not lead to any operational problems (such as bed sintering or poor temperature distributions) at either 2½ or 7 ft/s. Combustion efficiency was greater than 99 percent at 2½ ft/s and slightly lower (probably 98 percent) at 7 ft/s. Sulfur retention at 2½ ft/s was similar to that obtained in earlier tests with a 4 ft deep bed (i.e., increasing the bed depth does not improve sulfur retention). Retention at 7 ft/s was significantly lower, as expected, than at 2½ ft/s. There were some indications that coal distribution was more critical at 7 ft/s than at 2½ ft/s.

**20928** (FE—2288-16) **Direct sampling and characterization of gaseous species responsible for fireside corrosion in fossil fuel-fired systems. Fourth quarterly progress report, January 1—March 31, 1977.** Milne, T.A.; Beachey, J.E.; Greene, F.T. (Midwest Research Inst., Kansas City, Mo. (USA)). 18 Jul 1977. Contract EX-76-C-01-2288. 12p. Dep. NTIS, PC A02/MF A01.

It was found necessary to add extra $O_2$ to air to sustain lean or stoichiometric flames of 10 to 20 μm Freeport Seam Coal on 6.3 cm diameter burners. With 28 percent $O_2$, lean flames burned satisfactorily on both inverted and upright burners. Coal-air and coal-28 percent $O_2$-$N_2$ flames were sampled by direct free-jet sampling using an 0.020 in. diameter sonic orifice with an automatic cleaning device. Beam intensities were comparable to those with gaseous flames. However, noise from coal-flame particulates was serious. During a series of coal-flame sampling experiments, in both inverted and upright configurations, the particle noise increased 1,000-fold, making detection of alkali species impossible. Corrective measures to eliminate the particle-noise problem are discussed.

**20929** (PB—269556) **Preliminary environmental assessment of coal-fired fluidized-bed combustion systems. Preliminary report September 1975—June 1976.** Fennelly, P.F.; Durocher, D.F.; Klemm, H.; Hall, R.R. (GCA Corp., Bedford, Mass. (USA). GCA Technology Div.). May 1977. Contract EPA-68-02-1316. 150p. (GCA-TR—75-37-G). NTIS PC A07/MF A01.

The report evaluates potential pollutants which could be generated in coal-fired fluidized-bed combustion (FBC) processes. The primary emphasis is on organic compounds, trace elements, inorganic compounds (other than $SO_2$ and NO/sub x/), and particulates. Using available bench scale or pilot plant data and/or simple thermodynamics and empirical correlations with data from other combustion systems, order of magnitude estimates were made of the concentrations of various elements and compounds in the flue gas, in the solid waste, and in the water discharge.

**20930 Investigation of the behavior of the mineral matter of acid composition in high temperature combustion of coal.** Tager, S.A.; Rabiner, Ya.P.; Unger, M.K.; Talumaa, R.Yu.; Soone, L.K.; Ausmees, V.I. (Inst. of High Temperatures, Moscow). *Therm. Eng. (USSR) (Engl. Transl.);* 22: No. 11, 46-49(Nov 1976).

Translated from Teploenergetika; 22: No. 11, 42-45(Nov 1975).

The main factor determining vaporization of the mineral matter of fuel is temperature, however the effect of this factor varies appreciably with temperature. At T < 2000 to 2200°K, the amount of condensed phase (slag melt) becomes less than the amount of the

initial ash by a small quantity, corresponding to the vaporization of compounds of potassium, sulfur and iron. Appreciable further decrease in the amount of condensed phase, associated with vaporization of $SiO_2$, starts at T approximately 2400 to 2500°K and continues up to T approximately 3000°K. Increase in pressure, other conditions being equal, reduces vaporization of the mineral matter, correspondingly the amount of condensed phase increases. Other conditions being equal, an increase in oxygen concentration in the oxidizer and change from shortage to excess of oxidizer decrease vaporization of the mineral part. This leads to a corresponding increase in the amount of the condensed phase. Under actual operational conditions of combustion plant with liquid slag removal, for which conditions T $< 2200$°K, p = 0.1 MPa and $[O_2] = 21\%$ are always maintained, we do not expect any appreciable vaporization of $SiO_2$. Relatively strong vaporization of $SiO_2$ can take place only in special high temperature combustion chambers operating at a pressure of several atmospheres and at T approximately 2800°K. However, even in this limiting case the vaporized mineral matter will not exceed 30 to 40%.

## MARKETING AND ECONOMICS

*REFER ALSO TO CITATION(S) 21727, 21741*

**20931** (CONF-770658—, pp 189-221) **Coal supply and transportation overview.** Dotter, J. (National Coal Association, Washington, DC). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

The discussions are geared to slide presentations. Information is included on primary energy use, coal resource distribution, major coal markets, consumer distribution, coal transport, petroleum transport, and natural gas transport. (JRD)

**20932** **Coal: bituminous and lignite in 1975.** Washington, DC; Bureau of Mines (1977). 67p.

In 1975, production of bituminous coal and lignite reached an all-time high of 648.8 million tons, a 7.5 percent over the 603.4 million tons produced in 1974. The previous record production year was 1947 when production was 630.6 million tons. Despite the record output, bituminous coal and lignite consumption increased less than four million tons. Essentially all of the increase in production went into replenishing stockpiles which had been drawn upon heavily during the coal miners' strike in the fourth quarter of 1974, and to meet increased demands for export coal. The slowdown in the economy, particularly in the first half of 1975 resulted in only a nominal increase in electric utility coal consumption and a decline in coal requirements by steel companies. The average mine price of bituminous coal and lignite increased from $15.75 per ton in 1974 to $19.23 per ton in 1975. The average price of coal produced at underground mines increased from $19.86 per ton to $26.28 per ton. The average price of coal shipped from surface mines increased from $12.25 per ton to $13.44 per ton. The average rail freight charge on coal increased from $4.71 per ton in 1974 to $5.23 per ton in 1975.

**20933** **Der Kohlenbergbau in der Energiewirtschaft der Bundesrepublik im Jahre 1975. (Mining within the energy economy of the Federal Republic in 1975).** Essen, Germany, F.R.; Vela-Rohde (Oct 1976). 110p. (In German).

Seven chapters present a survey of German mining in 1975. Special emphasis is put on its position within the energy economy of the FRG. 115 tables deal with: the economic and personnel development, haulage and sales of coal, coke and briquets (balance of coal), energy consumption in the FRG, stockpiling of the economy with coal and coke and stocks in coal, coke and briquets, foreign energy trade and energy balances (primary energy generation and consumption). The annex presents figures on pit coal/brown coal haulage, coke production, petroleum and natural gas production, electricity generation and crude steel production, arranged according to countries. The data refers mainly to the period 1964 - 1975.

**20934** **Bituminous coal and lignite distribution. Calendar year 1976.** Washington, DC; Bureau of Mines (1976). 51p.

This report shows the distribution of bituminous coal and lignite in the United states during the calendar year of 1976 from coal producing districts of origin to geographic divisions and states of destination, broken down by methods of transportation and types of consumer use, and a comparative summary of total distribution during the calendar years of 1976 and 1975 by geographic divisions and states of destination, methods of transportation, and types of consumer use. This information provides individuals in the industry, the coal industry as a whole, the Government and others with a better understanding of the participation of bituminous coal and lignite in the various energy markets of the Nation, both locally and nationally. The detailed data provide a benchmark for special studies and analyses of many of the factors that influence coal production and utilization in the highly competitive energy market.

## HEALTH AND SAFETY

*REFER ALSO TO CITATION(S) 21689*

**20935** (MLM—2497(OP)) **Preliminary assessment of the impact of radionuclides in western coal on health and environment.** Styron, C.E. (Mound Lab., Miamisburg, Ohio (USA)). 1978. Contract EY-76-C-04-0053. 6p. (CONF-780109—1). NTIS, MF A01.

From Technology for energy conservation; Albuquerque, NM, USA (23 Jan 1978).

Portions of document are illegible.

Samples of coal, ash, stack effluents, airborne particulates, soil, and vegetation associated with a power plant using Western coal were prepared and analyzed by alpha pulse height spectroscopy. The data were then used in an effort to calculate the radionuclide balance for the power plant, to model radiation dose to the population adjacent to the power plant, and to estimate radiation doses for power plant workers. Details of sampling and analytical procedures are presented elsewhere. The greatest fraction of uranium-234 (87%), uranium-238 (87%), polonium-210 (87%), and lead-210 (82%) in feed coal remained with the ash after combustion. Electrostatic precipitators on the stack of Unit No. 2 of the Neal Station removed over 70% of the radionuclides entering the stack in association with fly ash, and thus the precipitators appear to be of value in controlling radionuclide emissions. Other particulate emission control devices, e.g., bag houses, should also be very effective in removing radionuclides that enter the stack in association with fly ash. Atmospheric diffusion modeling of stack effluents for uranium-234, uranium-238, lead-210, polonium-210, and radon-222 identified no radionuclides of dosimetric significance for inhalation or ingestion pathways. Occupational exposures of workers inside the Neal Station are also of no dosimetric significance. Furthermore, specific trends in distribution of radionuclides measured in the environment (airborne particulates, vegetation, and soil) relative to the power plant were not apparent. Use of Western coal in a modern power plant with effective emission controls has led to no significant environmental contamination by radionuclides.

## REGULATIONS

*REFER ALSO TO CITATION(S) 21738*

**20936** (NP—22802) **Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4—6, 1977.** (National Academy of Sciences, Washington, D.C. (USA)). 1977. 330p. Academy of Sciences, Washington, DC.

A national energy policy is considered ruled out not only by shifting public perceptions but also by the pervasiveness of energy. Energy is embodied in all goods and services. Formulating a supply policy toward energy is highly difficult, although possibly feasible. For demand it is considered simply impossible. The real problem is postulated to be that the public has not yet figured out what it wants. Implicit in the future is an array of social decisions. Important decisions include the fertility rate, desires about per capita income, and the work-leisure decision. Individual and social decisions on such issues are complicated, interdependent, and certain to change over time. A second major issue has to do with other sources of fuel: oil, natural gas, uranium, and so on. The third of the major points concerns risk. (LTN)

# PETROLEUM

*REFER ALSO TO CITATION(S) 20840, 21060, 21469*

## GEOLOGY AND EXPLORATION

*REFER ALSO TO CITATION(S) 20915, 20961, 20978, 21136, 21261, 22284*

**20937** (FEA/G—77/356) **U.S. oil and natural gas finding costs. Volume I.** (Shriver (R.) Associates, Parsippany, N.J. (USA)). Jul 1977. 150p. MF A01.

Portions of document are illegible.

The Finding Cost Study was conducted to establish costs for U.S. oil and gas exploration efforts historically, and to project the level of such costs in 1980, 1985, and 1990. Data was developed for

17 onshore and 2 offshore regions in the Continental U.S. where the petroleum industry has traditionally focused its operations. In addition, two onshore and two offshore sectors of Alaska as well as the offshore Atlantic Coast region that are now becoming the focal points of much new exploratory activity were also examined. The results of research are presented in terms of total dollar costs per foot drilled for oil and gas wells in six separate depth categories in each region. These data can be utilized with the output of two other FEA sponsored studies to project oil and natural gas replacement costs for future years in the United States. Volume I of the Finding Cost Study presents the results, and details the methodology used to develop the statistics.

**20938 (FEA/G—77/357) U.S. oil and natural gas finding costs. Volume II. Statistical appendix.** (Shriver (R.) Associates, Parsippany, N.J. (USA)). Jul 1977. 322p. MF A01.

Portions of document are illegible.

The study was conducted to establish costs for U.S. oil and gas exploration efforts historically, and to project the level of such costs in 1980, 1985, and 1990. Data was developed for 17 onshore and 2 offshore regions in the Continental U.S. where the petroleum industry has traditionally focused its operations. In addition, two onshore and two offshore sectors of Alaska as well as the offshore Atlantic Coast region that are now becoming the focal points of much new exploratory activity were also examined. The research results are presented in terms of total dollar costs per foot drilled for oil and gas wells in six separate categories in each region. Volume 2 is an appendix containing detailed finding cost statistics for regions in which historical information was available.

**20939 Petroleum and natural gas exploration in the Federal Republic of Germany in 1976. On the basis of data and drilling results of petroleum companies with activities in the Federal Republic of Germany.** Schroeder, L. (Niedersaechsisches Landesamt fuer Bodenforschung, Hannover (Germany, F.R.)). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **30**: No. 8, 349-357(Aug 1977). (In German).

A total of 235 070.2m were drilled in 1976, an increase of 14.4% over 1975. This activity resulted in four new finds: Leybucht Z 1 and Engerhafe Z 1 yielded natural gas in the Rotliegendes of Ostfriesland and Schwabmuenchen-Ost 1 in sandstones of the Dogger beta in the Alpine Foreland. Oil was found at Lauberhart 1 - also in the Alpine Foreland - in the Baustein layers (Rupel/Chatt). In spite of these successes the recoverable reserves decreased during 1976 because production was greater than new discoveries. Oil reserves declined by 2%, gas reserves by 3.3%.

**20940 Oil formation in the process of lithogenesis in the light of the systems approach.** Lopatin, N.V. (All-Union Scientific Research Inst. for Nuclear Geophysics and Geochemistry, Moscow). *Izv. Akad. Ncuk SSSR, Ser. Geol.;* No. 3, 113-121(Mar 1977). (In Russian).

It is suggested that systems analysis techniques be used to reproduce the actual historical process of oil formation as a part of the overall system of a sedimentary rock basin, in order to determine the conditions of transition of one stage of development of the object to another, determine interrelationships between elements of the system and peculiarities of its functioning, provide a detailed description of the mature stage of the process, the primary phase of oil formation, by partial solution of the problem and formulate the new problem of recognition of oil formation, closely related to the search for deposits of oil. The systems approach is a modern methodological orientation which, though it does not guarantee the production of true knowledge, since a great deal is determined by the reliability of the empirical basis of data, skill of the researcher and even such materialistic factors as intuition and creative imagination, does provide the possibility for creation of a single theoretical picture and development of mathematically founded concepts in this area of research.

**20941 Influence of hydrate formation on the information content of indicators of oil-bearing and gas-bearing potential.** Yakutseni, V.P.; Barkin, E.S. (All-Union Petroleum Scientific Research Inst. of Geological Exploration, Moscow). *Geol. Nefti Gaza;* No. 2, 29-32(Feb 1977). (In Russian).

The formation of gas deposits under permafrost conditions where the gas occurs in the solid (hydrate) form is considered. Analysis of thermodynamic and geological conditions has shown that such hydrates may form in the Soviet Union in Western and Eastern Siberia, and in Yakutia. It is shown that hydrate formation reduces the information content of data on the gas factor and gas diffusion aureole as indicators of oil-bearing and gas-bearing potential in low-temperature regions. Based on calculations of the change in gas composition as a result of hydrate formation it is found that the reliability of such indicators as the ratio of heavy hydrocarbons to methane and the ratio of n-butane to i-butane is distorted. When using any data on gases (both dissolved and free) as prospecting criteria for oil-bearing and gas-bearing potential in the northern and eastern part of the Soviet Union it is advisable to take the possibility of hydrate formation into account.

**20942 Nuclear techniques in exploration, extraction and processing of mineral resources. Report on the international symposium held in Vienna from 7 to 10 March 1977.** Donhoffer, D. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Isotopenanwendung); Furuta, T. (International Atomic Energy Agency, Vienna (Austria)). *At. Energy Rev.;* **15**: No. 3, 493-500(1977).

Thirty-one papers presented in seven technical sessions, covering the methods used in exploration for oil and gas, mining and processing of coal, mineral exploration and mining, and mineral processing are summarized.

**20943 Period of formation of rupture faults in the kyurovdag area section.** Kerimov, A.A.; Kerimov, K.M.; Ibragimov, S.M.; Chan, L.D. (Az SSR Inst of Chem and Gas im. M. Azizbekov, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 10-12(1977). (In Russian).

Based on a detailed analysis of the specific features of variation in the thickness of Plioceno-Quaternary deposits in the Kyurovdag area, an identity of conditions of the development of folds and ruptures in this area is revealed. A method of exploration of oil and gas deposits in this area is set forth.

**20944 Structure of the Naturaliste Plateau and Trough.** Jongsma, D.; Petkovic, P. *APEA J.;* **17**: 3-12(1977).

The Naturaliste Plateau is a broad, relatively flat feature lying at a depth below sea level of around 2500 m off the continental margin of southwest Australia. This paper discusses the origin, structure, and stratigraphy of the Plateau, and evaluates the hydrocarbon potential beneath it. It is concluded that water depths of 2500 m over the Plateau and 3500 m in the Trough would make the recovery of hydrocarbons presently impractical. 31 refs.

**20945 Investigations into the carbonaceous reservoirs of the Paleozoic deposit of the South East Dnieper-Donetsk hollow.** Prilipko, I.P. pp 80-83 of In Geophysical exploration data processing and interpreting. Kiev; Tekhnika (1976). (In Russian)

Explorations with different geophysical methods of the carbonate reservoirs in the Paleozoic deposits of the south-east part of the Dnepr-Donetsk region are reviewed. It is stated that further investigations are needed on the different reservoir properties of rocks, which are connected with oil and gas deposits.

**20946 Methods for interpretation of geophysical exploration data from heterogeneous carbonate reservoirs with compound porous space (on the example of Lower Cretaceous and Upper Jurassic deposits in ChI ASSR).** Nechai, A.M.; Boyarchuk, A.F.; Kuzhel, A.A. *Neftegazov. Geol. Geofiz.;* No. 11, 38-42(1975). (In Russian).

A method for interpreting the data from electrometry and neutron gamma logging for the purpose of determining the productivity of complex fissure-cavity-porous carbonate reservoirs is considered. Using as an example the Lower Cretaceous and Upper Jurassic deposits in a series of petroleum fields in the ChI [Checheno-Ingush] ASSR the possibility was shown of using the method effectively in studying nonhomogeneous carbonate reservoirs with complex structure of the porous area.

**20947 One-dimensional inversion of seismograms.** Eisner, E. (Texaco Inc., Bellaire, TX). pp 111-116 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Seismic exploration attempts to recover the acoustic structure of the earth from observations made at the accessible surface. Depositional history often makes a plane-layered model a reasonable first approximation to the structure. Field techniques do not correspond to the use of plane waves, and a method of extracting the equivalent of such observation from data is discussed. Thus it is of interest to consider the inversion problem for this one-dimensional case. One method for performing such an inversion is presented, and attendant problems are discussed.

**20948 U.S. Geological Survey project BIRDDOG (basic investigation of remotely detectable deposits of oil and gas).** Donovan, T.J. (Geological Survey, Denver). pp 414 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

An experimental program to develop an integrated remote sensing-geochemical petroleum exploration technique has been established by the U.S. Geological Survey. Briefly, the concept is based on previous and ongoing research within the U.S. Geological Survey which demonstrates that imperfect rock seals capping petroleum and natural gas deposits may permit large volumes of low-molecular-weight hydrocarbons to escape to the surface, with one or more of the following results: (1) the slowly seeping hydrocarbons

chemically and biochemically oxidize; (2) liberated $CO_2$ is incorporated into carbonates, forming pore-filling cements invested with unique isotopic signatures; (3) gas, expansive under depressurization, evaporates near-surface pore water, likewise precipitating isotopically distinctive pore cements; (4) the highly reducing hydrocarbons and associated compounds cause discoloration of surface strata by reduction and dissolution of iron. All these late diagenetic alteration phenomena reflect the subsurface distribution of petroleum. The BIRDDOG program in part attempts to explore for these kinds of surface anomalies using the following integrated approach: (1) Initial reconnaissance of key petroleum regions with computer-enhanced LANDSAT satellite multispectral imagery to isolate areas displaying surface alterations of the kinds discussed above. (2) Underflight verification of anomalous areas identified in step one. (3) Detailed field mapping and sampling based on priorities assigned in step two. (4) Geophysical investigation to provide third-dimension data.

## DRILLING AND PRODUCTION

*REFER ALSO TO CITATION(S) 20841, 21004, 21728, 21735*

**20949** (BERC/RI—77/16) **Heavy oil recovery using solvents and explosives.** Heath, L.J.; Johnson, F.S.; Miller, J.S.; Jones, R.A.; McMurtrie, W.D. (Department of Energy, Bartlesville, Okla. (USA). Bartlesville Energy Research Center). Dec 1977. 48p. Dep. NTIS, PC A03/MF A01.

Petroleum-recovery techniques are being developed for the many shallow, low-productivity, heavy-oil sand deposits in southeastern Kansas, southwestern Missouri, and northeastern Oklahoma. In 1971, laboratory flooding experiments were conducted to determine optimum field operating conditions for recovery of heavy oil. Concurrently the Research Center began a field experiment in Labette County, Kans., using a recovery method (SolFrac) that combines chemical-explosive fracturing, to create communication with solvent injection, to improve mobility. The general boundaries of heavy-oil deposits are reported, and the areal extent and general characteristics of the reservoir in Labette County are described. The fracturing, injection, and production techniques and the production results from the field experiment are described. About 14% of the solvent injected was not recovered and thus was lost to the formation. Roughly 27 percent of the oil-in-place within the five-spot interwell zone was recovered. Reinjection of the produced solvent-oil mixture was done on a limited basis. Not enough additional oil was picked up during recycling of the solvent to justify this procedure. 9 tables, 21 figures.

**20950** (BERC/TPR—77/11) **Electrodril System Field Test Program, interim phase. Final report, January—April 1977.** (Department of Energy, Bartlesville, Okla. (USA). Bartlesville Energy Research Center). Feb 1978. 24p. Dep. NTIS, PC A02/MF A01.

The Interim Phase between Phase 1 Testing and the Phase 2 Major Drilling System Test included more detailed analyses, some redesign, and additional field testing required to rectify three problems that surfaced during Phase 1 Testing: motor lower seal failures, excessive wear of bit shaft seal, and cable/connector failures. The Phase 1 Motor Lower Seal Failures were found to have been caused by failure to rigidly fix the Face Seal Stator and by having the Face Seal inversely designed into the motor system. Downhole testing with the seal inversely installed but with the stator rigidly fixed demonstrated that the seal performed satisfactorily. In all subsequent use of the motor, the seal should be configured as recommended by the manufacturer. Interim Phase Downhole Testing demonstrated that a properly refurbished bit shaft is capable of functioning satisfactorily in a drilling environment. Seal wear experienced during test indicates that these seals should be replaced periodically. The Interim Phase was used to provide extensive analysis into Phase 1 Cable/Connector Failures, evaluation of potential cable conductor insulation material, evaluation of stronger, more rigid material for fabricating the male connector body, and evaluation of "Bondability" of materials used in connector fabrication and cable insulation. These analyses and evaluations were used as inputs in the design, fabrication, and procurement cycle to yield a new replaceable Electrodril connector pair and armored cable with water blocked MS type connectors capable of accepting the replaceable Electrodril connectors. Repeated downhole matings were made during test. The cable and the replaceable male connector performed flawlessly. The internal conductor rings in the replaceable female connector gradually became oversize as the test progressed. Subsequent female connector rings will be fabricated using a harder, springier material to assure successful downhole mating even after extensive use.

**20951** (COO/0029—1) **North Stanley Polymer Demonstration Project. First annual report.** (Kewanee Oil Co., Tulsa, Okla. (USA)). 26 Jul 1976. Contract EY-76-C-02-0029. 169p. Dep. NTIS, PC A08/MF A01.

The objective of the project is to demonstrate the efficiency and economics of recovering tertiary oil from a highly heterogenous reservoir (which has been successfully waterflooded, but is nearing the economic limit) by injecting a polymer slug of tapered concentrations to improve the sweep efficiency of the reservoir. In preparation for the injection of polymer, a major review of the mechanical condition of all producing and injection wells prompted a number of remedial workovers. As a preventive measure, all injection wells were equipped with plastic coated tubing, and packers were set approximately 100 ft above the Burbank sand to prevent the possibility of subsequent casing leaks thieving off injected polymer. Where necessary, producing wells were worked over to insure maximum producing capability. The remedial work was done at the start of the project to insure that any production increase resulting from the remedial work was recognized prior to the start of polymer injection. The necessary surface facility changes were made to allow the injection of fresh water only and to provide for the disposal of 35,000 BPD of produced water. Polymer storage and blending facilities were constructed in such a manner as to allow control of the mixing process with a minimum of supervision and manpower. In September a one well mini-injection test was conducted which included a fresh water preflush period, injection of 5,000 lb of Pusher 700 at 1,000 ppM followed by 1,000 lb of Pusher 1,000 at 100 ppM, and a fresh water afterflush period. The mini test established that there would be no significant well bore problems associated with the injection of the polymer.

**20952** (COO/4098—1) **Full-scale laboratory drilling tests on sandstone and dolomite. Final report.** Black, A.D.; Green, S.J.; Rogers, L.A. (Terra Tek, Inc., Salt Lake City, Utah (USA)). Aug 1977. Contract EY-76-C-02-4098. 209p. Dep. NTIS, PC A10/MF A01.

Full-scale laboratory drilling experiments were performed under simulated downhole conditions to determine what effect changing various drilling parameters has on penetration rate. The two rock types, typical of deep oil and gas reservoirs, used for the tests were Colton Sandstone and Bonne Terre Dolomite. Drilling was performed with standard $7^7/_8$ inch rotary insert bits and water base mud. The results showed the penetration rate to be strongly dependent on bit weight, rotary speed and borehole mud pressure. There was only a small dependence on mud flow rate. The drilling rate decreased rapidly with increasing borehole mud pressure for borehole pressures up to about 2,000 psi. Above this pressure, the borehole pressure and rotary speeds had a smaller effect on penetration rate. The penetration rate was then dependent mostly on the bit weight. Penetration rate per horsepower input was also shown to decrease at higher mud pressures and bit weights. The ratio of horizontal confining stress to axial overburden stress was maintained at 0.7 for simulated overburden stresses between 0 and 12,800 psi. For this simulated downhole stress state, the undrilled rock sample was within the elastic response range and the confining pressures were found to have only a small or negligible effect on the penetration rate. Visual examination of the bottomhole pattern of the rocks after simulated downhole drilling, however, revealed ductile chipping of the Sandstone, but more brittle behavior in the Dolomite.

**20953** (FE—2515-10) **Supply of carbon dioxide for enhanced oil recovery. Final report, October 15, 1976—September 1, 1977.** Rump, W.M.; Hare, M.; Porter, R.E. (Pullman Kellogg, Houston, Tex. (USA)). Sep 1977. Contract EX-76-C-01-2515. 128p. Dep. NTIS, PC A07/MF A01.

Results are presented from a study of the carbon dioxide supply situation for miscible flooding operations to enhance oil recovery. Candidate oil reservoirs were identified, and the carbon dioxide requirements and the potential recoverable oil for some of these were estimated. A survey of carbon dioxide sources has been conducted within the geographic areas where candidate oil reservoirs exist. Sources considered were both high and low quality gases from combustion vents, chemical process stacks, and naturally occurring gas deposits. The survey shows more than enough carbon dioxide is available from above-ground sources alone to meet expected demands. Systems to purify and deliver the carbon dioxide were designed and the costs of the delivered carbon dioxide estimated. Lowest cost is carbon dioxide from natural source with credit for by-product methane. A more comprehensive survey of above-ground and natural sources is recommended.

**20954** (ORO—5301-18) **Oil recovery by carbon dioxide injection. Annual report, July 1976—July 1977.** SanFilippo, G.P. (Pennzoil Co., Vienna, W.Va. (USA)). Sep 1977. Contract EF-76-C-05-5301. 149p. Dep. NTIS, PC A07/MF A01.

Activities are reported in a pilot project to determine the oil recovery efficiency of a multiple contact carbon dioxide miscible flood and to define and evaluate operational problems associated with this particular recovery method. The quantitative data gathered as a result of the installation of the project and the injection performance experienced thus far conform to expectatons. The pilot test site in the Rock Creek West Virginia field was selected and designed to utilize a maximum number of existing wells and cause

minimal disruption of the active low pressure gas recycle while considering the area of perforating of the net sand interval followed by a 2,000 gallon hydrochloric acid breakdown. Prior to carbon dioxide injection, internally plastic coated tubing will be run on a packer for an injection string in an attempt to minimize possible corrosion problems. On October 16,1976, water injection started into eight of the thirteen back-up water injection wells. Injection into the remaining five back-up wells was initiated by November 11, 1976. As of July 1, 1977, 351,219 barrels of water had been injected into these thirteen wells. The start of injection into the six pattern injection wells was delayed until April 22, 1977 which corresponds to the completion of the northern water supply system. As of July 1, 1977, cumulative injection into these six wells was 48,600 barrels of water. Contract negotiations and the finding of an adequate source of water for injection caused a delay of four months in the initial project schedule. The start of carbon dioxide injection could possibly be delayed until the first quarter of 1978 to insure an uninterrupted carbon dioxide supply.

**20955** (ORO—5302-16) **Tertiary oil recovery by $CO_2$ injection.** Conner, W.D. (Columbia Gas Transmission Corp., Charleston, W.Va. (USA)). Dec 1977. Contract EF-76-C-05-5302. 51p. Dep. NTIS, PC A04/MF A01.

Progress in a field test is to evaluate and demonstrate the effectiveness of using $CO_2$ injection to recover high gravity crude oil from shallow watered-out reservoirs is reported. The reservoir was repressured to approximately 1000 psi with water prior to $CO_2$ injection. The plant was completed and injection began on June 2, 1976. The $CO_2$ slug was injected in several stages, alternating with water periodically for mobility control and better sweep efficiency. With interruption for the worst winter weather in the area's history, $CO_2$ injection was completed on June 14, 1977, with a total injection of approximately 9878 tons. Soon after injection began, unexpected increases in oil production occurred both inside and outside the pattern. $CO_2$ was also detected in the produced gas from these wells. These production increases were without accompanying water increases as had been expected. These, and other continuing "puzzles", are described. Through June 30, 1977, approximately 5720 barrels of oil had been produced as a result of $CO_2$ injection. (JRD)

**20956** (ORO—5303-15) **Tertiary oil recovery by $CO_2$ injection. Quarterly report, April—June 1977.** Conner, W.D. (Columbia Gas Transmission Corp., Charleston, W.Va. (USA)). Nov 1977. Contract EF-76-C-05-5302. 26p. Dep. NTIS, PC A03/MF A01.

Progress is reported in a field test to evaluate and demonstrate the effectiveness of using $CO_2$ injection to recover high gravity crude oil from shallow watered-out reservoirs is reported. After resumption of $CO_2$ deliveries in mid-March, $CO_2$ injection continued without interruption until June 14, 1977 when this phase of the project was completed. Phase 5 (water injection) began at this time. At the conclusion of Phase 4, approximately 19,760,000 pounds had been injected into the four input wells. The resumption of injection resulted in an almost immediate response in the reservoir. Bottom hole pressure tests taken during the period showed a steady increase in April and May. Production also showed marked increases, particularly Wells 4254 and 2044. The latter was pumped beginning in May, whereas 4254 remained flowing. Total production through June 30, 1977, directly attributable to $CO_2$ injection, was approximately 5720 barrels. (JRD)

**20957** **Drilling technique in the development of the North Sea's Forties Field.** Hartz, H.E. (Dtsch Br Pet, Hamburg, Ger). *Erdoel-Erdgas Z.;* **93**: No. 7, 230-234(Jul 1977). (In German).

Some 350,000 b/d of oil are now being produced from the North Sea's Forties Field. Total recoverable oil reserves are put at about 250 million tons. As many as 106 wells will be drilled from four steel structures already installed in about 400 ft of water. A sophisticated computer program developed to control the overall drilling operation and a special mud system designed to meet the technical and geological requirements are part of the drilling technology described here.

**20958** (PB—269951) **Liquid hydrocarbon production in the United States, 1946-75 and 1980 projected, highlighting enhanced recovery. Information circular.** Carrales, M. Jr; Funk, V.T. (Bureau of Mines, Dallas, Tex. (USA). Div. of Petroleum and Natural Gas). 1977. 86p. (BM-IC—8734). NTIS PC A05/MF A01.

This report presents an evaluation of the short-range availability of domestic liquid hydrocarbon production through 1980. Estimates of future crude oil and natural gas liquid production were made for each oil-producing area of the United States. Results of estimates for primary, enhanced, and total crude oil production are presented in tabular and graphic form for each producing area and summarized by Petroleum Administration for Defense (PAD) districts.

**20959** (SAN/1396—12) **Improved secondary oil recovery by controlled water flooding-pilot demonstration Ranger Zone, Fault Block VII, Wilmington Field. Phase I. Quarterly report, July—September 1977.** (City of Long Beach, Calif. (USA)). 20 Oct 1977. Contract EF-77-C-03-1396. 20p. Dep. NTIS, PC A02/MF A01.

Progress is reported in an improved waterflood demonstration of caustic waterflooding in a typical, well flood pattern of the Ranger Zone of the Long Beach Unit portion of the Wilmington Field. Two alkaline flood processes are to be used in this demonstration. The demonstration involves the input of 30,000 B/D water in 8 injection wells which surround 11 active producers in an area of 95 acres. Laboratory core testing is now proceeding satisfactorily after prior problems with core plugging which required core cleaning before flooding. A number of core floods have either been completed or are currently underway on the "entrapment" aspects of caustic flooding. Initial NaCl—NaOH flood tests have also been begun. Producing and injection well work continued routinely. Other routine work consisting of bottom hole pressure surveys, production well testing, fluid entry surveying, pump changes, injection well profiling, etc. is proceeding according to plan. The production performance of the pilot area and adjacent rows through August, 1977 is shown in graphs. The mini-injection test was completed during the quarter; a report detailing the findings of the test is now being prepared. Special logging programs involved the running of the "dielectric log" in the B-831-I injection well redrill in August along with other appropriate well logs. The quantitative work for determination of reservoir rock properties from the dielectric log and the companion laser log suite is now in progress.

**20960** **Ignition process for downhole gas generator.** Hamrick, J.T.; Rose, L.C. (to World Energy Systems). US Patent 4,053,015. 11 Oct 1977. Filed date 16 Aug 1976. 6p.

A process of igniting a downhole generator having a fuel conduit and an oxidizing fluid conduit extending from the surface to the generator for supplying a fuel and an oxidizer to its chamber is described. Coupled to the two conduits near the generator are two solenoid control valves which are controlled from the surface. In carrying out the process, the valves are closed and a slug of hypergolic fuel is injected into the fuel conduit and an oxidizing fluid injected into the oxidizing fluid conduit. A generator fuel is injected into the fuel conduit behind the hypergolic fuel. The two valves are opened to allow the hypergolic fuel and oxidizer to pass into the chamber to cause spontaneous ignition of the hypergolic fuel to ignite the generator fuel and an oxidizer which follow. 5 claims, 1 figure.

**20961** **Developments in the Irish offshore industry.** *Pet. Rev.;* **31**: No. 367, 3, 5-6(Jul 1977).

Advances in offshore drilling and extraction technology in Ireland are highlighted. Since 1970 thirty oil and gas exploration wells have been drilled off the south coast of Ireland in the relatively shallow area known as the Celtic Sea. This activity has resulted in one proven gas field (the Kinsale Head Field) and the identification of possible oil reserves. The involvement of Irish companies in servicing the drilling and seismic work of the majors is also briefly reviewed.

**20962** **Dunlin concrete platform--start to finish.** *Pet. Rev.;* **31**: No. 367, 10-12(Jul 1977).

Construction of the Dunlin drilling and production platform, scheduled to be placed this year in the 155 meter deep water of the North Sea on the Dunlin Field, is briefly described. Design and deep water compeltion of the 420,000-tonne platform which was built in only two years are also briefly covered. The platform incorporates more than 100,000 cu meters of concrete and 50,000 tons of associated steel work.

**20963** **Some results of investigation of the functioning of antivibration devices.** Ogorodnikov, P.I.; Plisak, V.F.; Ogorodnikova, G.N.; Borisevich, B.D. (Ivano-Frankovskii Inst of Oil and Gas, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 15-16(1977). (In Russian).

Results of tests of shock absorbers KAN-195, VGAZ-4, ABO-32-240 at the Nadvornaya oil well drilling division (West Ukraine) of the "Ukrneft" production conglomerate are presented. Relying on test results, recommendations are given on the selection of the parameters of antivibration devices, depending on the arrangements of the bottom of the string of drill pipes, the properties of the rock drilled, and other parameters.

**20964** **Dynamic models used in planning operating parameters.** Agaev, S.G. (Az SSR Inst of Pet and Chem im. M. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 17-20(1977). (In Russian).

Based on an information model having a probabilistic character, changes in the main parameters of rock rheology are forecast for the first time. For this purpose, an algorithm of self-adjustment of regime parameters, relying on the data arriving at the input and received at the output, is presented.

**20965** **Thermostable flushing fluids for well drilling in West Siberia.** Evdokimov, B.V.; Kozubovskii, A.I.; Makarov, L.V.

(Sverdlovsk Min Inst im. V.V. Vakhrusheva, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 21-25(1977). (In Russian).

The effect of high temperatures on flushing fluids prepared from clay powders and from the drilled rock is investigated. The conductometry method is utilized to obtain data about changes in the structure of the chemical reagents. The chemical reagents used were: carboxymethylcellulose, nitrolignin, and "igetane", as well as aqueous-alcohol solutions of sodium organylsiliconates marketed under the technical name of "hydrophobizing siliconorganic fluids". The results of tests show that siliconorganic fluids are highly thermostable.

**20966 Obtaining a circular rotating field in a capacitor electrodrill operating at different depths.** Mamedov, F.A.; Kurilin, S.P.; Kasumbekova, Z.M. (Moscow Power Eng Inst, Smolensk, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 29-33(1977). (In Russian).

Problems of obtaining a rotating field in a capacitor motor and determining minimal fluctuations of the rotor rpm rate with electrodrill loading and operation at different depths are considered. It is found that, as the electrodrill sinks deeper, a circular field point changes; the capacity connected to the stator field of the electrodrill must be reduced at great depths. There exists a certain regularity of capacity variation depending on the depth of drilling, for which instability of the instantaneous rotor rpm rate is minimal for a given load.

**20967 Selection of objects for exerting an effect on bottom hole zone, given a great number of dependent characteristics.** Chubanov, O.V.; Bogopol'skii, V.O. (Az SSR Inst of Pet and Chem im. M. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 35-38(1977). (In Russian).

The problem of selecting boreholes for effective hydraulic fracturing of a stratum, given a considerable number of dependent factors influencing the result of the action, is considered. It is proposed to use the method of principal components to reduce the number of dependent factors and to classify the boreholes according to the degree of their effectiveness.

**20968 Models accounting for the phenomenon of delay in liquid filtration through a porous medium.** Ametov, I.M. (Ukhtinsk Ind Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 58-60(1977). (In Russian).

Filtration models, into which delay time has been introduced, are considered. A comparison between adequacy of the models and experimental data is made. Based on selected models, identification equations are constructed. 10 refs.

**20969 Oil and gas separation on inclined shelves.** Bekhman, I.M.; Sinaiskii, E.G. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 70-74(1977). (In Russian).

The motion of a gas-and-oil mixture in a thin layer on an inclined plane under a constant external pressure is investigated. The dynamics of a single bubble is considered, taking into account its diffusion growth. Assuming a low volumetric concentration of bubbles, the degree of separation of the mixture, as well as changes in the distribution of the bubbles by size, are determined. It is shown that, within the framework of the proposed model, the efficacy of the inclined shelf as a separating device, given a short time of stay of the mixture on the shelves, is low.

**20970 Determination of the service life of drill pipes according to the cyclic strength criterion, taking account of loadings during lifting and sinking operations.** Kerimov, Z.G.; Gnilke, V.; Mamedova, P.M. (Az SSR Inst of Pet and Chem im. M. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 101-106(1977). (In Russian).

The service life of any stand implanted on the string of drill pipes during sinking and lifting operations is determined. Characteristics of the pipe material, the number of trips of the tool and the distribution of the dynamic loads arising in this connection are taken into account.

**20971 Shape of the bottom of a drill pipe string in a borehole.** Lebedev, N.F.; Sesyunin, N.A. (Perm State Univ, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 27-31(1977). (In Russian).

Deflecltion of a drilling shaft in a vertical borehole, following a loss of longitudinal stability, is considered. Taking account of the three-dimensional form of the deflection, the force of the bottom reaction and the bit slant are determined. The bit axis and the bottom reaction force are found to lie in different vertical planes, which must lead to the three-dimensional shape of the borehole deflection. 14 refs.

**20972 Investigation of the motion of a solid particle under the conditions of the rotary method of drilling.** Agaev, G.F. (Az SSR Polytech Inst im. Ch. Il'dryma). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 32-36(1977). (In Russian).

The spiral motion of a solid particle under the conditions of a rotary method of drilling is considered and an analytical expression is derived to determine its absolute velocity.

**20973 Oil displacement under elastic operating conditions.** Khalikov, G.A.; Shirgazin, R.G. (Bashk State Univ, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 37-40(1977). (In Russian).

A liquid filtration equation is derived taking account of the dynamic stratum capacity. The problem of injection of a liquid following a change in the dynamic capacity is considered in the form of an exponential relation. Applying the theory of nonlinear-elastic conditions of filtration, approximate-analytical solutions are obtained for the determination of pressure in the regions of the injected and displaced liquids and of other related flow characteristics.

**20974 Problem of determination of the magnitude of anomalous oil layers clogging bottom hole zones of strata.** Abdulin, F.S.; Lapshin, V.I.; Alekseev, G.A. (Ivano-Frankovskii Inst of Pet and Gas, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 47-50(1977). (In Russian).

A method of determination of the mean value of the thickness of anomalous layers of oil formed in the porous space of bottom hole zones of strata is worked out. It utilizes data on the changes in the averaged radii of porous channels. Thicknesses of the anomalous oil layers, obtained by this method, have the same values as those determined in accordance with changes in the permeability of the bottom hole zone of a stratum following borehole electric heating. 10 refs.

**20975 Investigation of the flow of an aqueous solution of polyacrylamide in narrow slots.** Gurbanov, R.S.; Aliev, V.A.; Mamedova, M.A. (Az SSR Inst of Pet and Gas im. M. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 59-61(1977). (In Russian).

As a result of an experimental investigation of the flow of an aqueous solution of polyacrylamide (PAA) in narrow slots, it is found that, with a rise in temperature, the maximum shear stress and structural viscosity decrease; with an increase in the slot height both and decrease. With a rise in PAA concentration, other conditions being equal, the absolute value of maximum shear stress increases. The absolute value of pressure has a noticeable effect on the maximum shear stress value.

**20976 Question of restoration of injectivity of injection wells and problem of control of the gushing process.** Nadzhafov, E.M.; Akhmedov, Ch.M. (Az SSR Polytech Inst im. Ch. Il'dryma). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 91-97(1977). (In Russian).

A scheme is proposed for the process of restoration of injectivity of injection wells by the pulse gushing method. The structure of a mathematical model of the process is given. Analytical expressions are presented for different laws of fracturing/washing-out of bedding. The data of this analysis are utilized to work out recommendations for practical simplementation of the research results for the purpose of controlling the process.

**20977 Phenomenon of jamming in single rolling cutter bit bearings.** Nasibov, N.A. (Az SSR Polytech Inst im. Ch. Il'dryma). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 105-107(1977). (In Russian).

Problems of jamming in single rolling cutter bit bearings with a spherical rolling cutter are considered. To evaluate the degree of reliability of a bit with regard to jamming, a criterion is proposed, namely the coefficient of jamming friction (c.j.f.). An analytical dependence between the c.j.f. and the design parameters of a bit is derived. As an example, graphs of dependence of the c.j.f. on the angle between the axes of the rolling cutter and the bit are presented. 8 refs.

**20978 Occurrence, prediction and control of geopressures on the northwest shelf of Australia.** Nyein, R.K.; MacLean, L.; Warris, B.J. *APEA J.;* **17**: 64-72(1977).

Careful velocity studies are carried out by the geophysicists in areas without well control in order to outline zones of abnormally low velocities which are correlated with geopressuring. From these data for any wildcat well, a suitable casing program can be devised prior to commencement of drilling. This will aim at sealing off any geopressured zones and thus allow rapid and trouble-free drilling with the correct mud density. During the drilling of the well, the modified 'd' exponent method is used to detect the actual zones of geopressuring within the well. These methods have allowed the problems of geopressures to be overcome and have considerably improved drilling times on the Northwest Shelf. A case history of one wildcat well, Lewis No. 1A, is presented. 22 refs.

**20979 Analysis of the production performance of the Windalia Sand Reservoir of the Barrow Island Oil Field.** Williams, C.T. *APEA J.;* **17**: 105-113(1977).

The Windalia Sand is a high porosity, low permeability oil reservoir. Currently 454 wells penetrate the unit for production or water injection operations, and are drilled on a north-south, east-west 16 ha (40 ac.) spacing. Early production performance data indicated a trend of water break through into wells located east and

west of water injection wells in an inverted nine-spot pattern. A detailed geological review of well data was initiated to investigate causes and possible controls of the phenomenon and to determine if oil recovery could be improved. This work was augmented by an engineering study of production data. Subsequently, a computer model was developed to investigate the simulated effects of changes to well patterns on the field's production performance. 6 refs.

**20980 Prediction of reserves and production performance by simulation: Halibut Feld.** Taylor, N.F. (Esso Aust Ltd). *APEA J.;* **17**: 114-120(1977).

As a result of a 1974 reservoir engineering study, which formed part of the basis for a 53% increase in estimated Halibut reserves, predictions of near term performance have proved to be reasonably accurate and substantiated a decision in 1974 to program installation of artificial lift facilities for a 1978 start-up. The simulation study resulted in Halibut reserves being revised upwards to 82.1 Mt (653 million barrels) and indicated that the production capability of the field would not start to decline rapidly until beyond 1977/78. In addition, the study has allowed gas lift facilities to be appropriately sized and scheduled for start-up. 6 refs.

**20981 Early subsea production system.** Van Bilderbeek, B.H. (Vetco Offshore Inc, Ventura, Calif). *APEA J.;* **17**: 131-136(1977).

In order to extend production technology into deeper waters, alternatives to fixed platforms must be developed. The semisubmersible production platform offers one such solution. Three variations of the subsea equipment to be used with the semi are presented. These three are, the Modular Template System offering flexibility with respect to the number of template wells to be drilled, the Unitized Template System with a one-time installation for eleven wells, and the Satellite System which ties in several exploratory wells. Although each variation offers particular advantages, all three satisfy the primary considerations of an ideal production system.

**20982 Wells drilled for oil and gas in Nevada through 1976.** Garside, L.J.; Schilling, J.H. Reno, NV; Nevada Bureau of Mines and Geology (1977). vp. .

A map is used to locate the wells. Information is included concerning drilling date, well depth, and drilling organization. Information is also included concerning the status of the wells. (JRD)

**20983 Increasing the endurance limit and corrosion resistance of light-alloy drill pipes.** Pokhmurskii, V.I.; Prishlyak, A.M.; Levchenko, A.T.; Gil'man, K.M. (Physicomech Inst, Acad of Sci of the Ukr SSR, L'vov). *Sov. Mater. Sci. (Engl. Transl.);* **12**: No. 5, 530-532(1976).

One of the effective ways of increasing the corrosion-fatigue strength and life of light alloy drill pipes (LADP) is to add certain inhibotors to the corrosive drilling media. A mixture of oil tar (MOT) and alkaline waste from diesel oil (AWDO), which are cheap, readily available, and byproducts of the oil, fat, and petroleum-refining industries have been tried for this purpose. A series of electrochemical and corrosion-fatigue tests have been conduted with D16T alloy in various corrosive media (similar in action to common drilling media) to determine the efficacy of the inhibiting agents. A description of the laboratory and field tests is given. The corrosion rate of D16T alloy in solutions with inhibitors was, on an average, 0.05-0.1 g/mm$^2$h, and pipe wear did not exceed 0.5-0.8 mm. The studies and field tests have shown that inhibitors can be effectively used to increase corrosion resistance and life of aluminum pipes in corrosion drilling media.

## PROCESSING

*REFER ALSO TO CITATION(S) 21001, 21002, 21004, 21008, 21009, 21010, 21011, 21012, 21013, 21014, 21016, 21017, 21018, 21043, 21048*

**20984 Hydrogen-producing hydrocarbon conversion with gravity-flowing catalyst particles.** Greenwood, A.R. US Patent 4,069,137. 17 Jan 1978. Filed date 26 Oct 1976. 12p.

A multiple-stage catalytic conversion system is claimed in which a hydrocarbonaceous charge stock is reacted in a plurality of stacked catalytic reaction zones through which catalyst particles flow downwardly via gravity-flow. The charge stock, in the absence of added, or recycled hydrogen, is reacted first in the lowermost reaction zone, from which deactivated catalyst particles are withdrawn from the system. Resulting reaction zone effluent is further reacted in the uppermost reaction zone, through which fresh, or regenerated catalyst particles are introduced into the system, and serially in one or more subsequent, lower reaction zones. Product effluent from the reaction zone immediately above the lowermost zone is separated to recover the desired normally liquid product.

**20985 Desulfurization of petroleum residues and their carbonization properties.** Mochida, I. (Kyushu Univ., Fukuoka); Maeda, K.; Takeshita, K.; Kaji, N.; Suetsugu, Y.; Yoshida, T. *Fuel Process. Technol.;* **1**: No. 2, 103-115(Jan 1978).

The desulfurization of petroleum residues of high sulfur content was carried out using three kinds of Lewis acids under a nitrogen flow of atmospheric pressure at 150 to 330°C. Considerable amounts of sulfur were eliminated from the residue as hydrogen sulfide with the aid of aluminum chloride at 150°C or higher temperatures. Ferric or zinc chloride was found also to eliminate sulfur from the residue in the form of the corresponding metal sulfides at 330°C without the evolution of hydrogen sulfide. Effects of such desulfurization on the coking properties were observed by means of optical microscopy and X-ray diffraction. Although the original residues gave cokes with a mosaic arrangement of anisotropic domains, benzene-soluble fractions of the desulfurized residue gave a graphitizable needle coke. The desulfurized residues were further analyzed by chemical techniques to study the structural change brought about by acidic desulfurization. This kind of desulfurization was revealed to be carried out without decreasing the aromaticity of the residue, being different from the hydrodesulfurization with cobalt—molybdena catalysts.

**20986 Hydrocarbon upgrading process.** Suggitt, R.M.; Gates, W.C. Jr. (to Texaco Inc.). US Patent 4,042,490. 16 Aug 1977. Filed date 26 Dec 1973. 10p.

A process is claimed for converting mixtures of $C_6$ to $C_{30}$ n-paraffin and n-paraffin by-products to substantially pure n-paraffin which comprises catalytically hydrogenating the mixture at a temperature of from about 600 to 750°F in the presence of a Group VIII metal on alumina catalyst where the catalyst contains from about 0.05 to 2.0 weight percent of an alkali metal oxide or alkaline earth metal oxide or thallous oxide. The catalyst can additionally contain a Group VIB or VIIB metal.

**20987 Multistage cooling of crude hydrocarbon gases.** Frank, H.; Langebach, H.P. (to Linde AG). US Patent 4,040,266. 9 Aug 1977. Priority date 23 Aug 1975, German, Federal Republic of (F.R. Germany). 6p.

Crude gas, such as cracking gas, is subjected after quenching to a two stage cooling system wherein water is employed in the first stage as both a direct contact coolant and scrubbing agent to remove condensed out hydrocarbons and solids from the gas. The scrubbing liquid in the first stage is subjected to a rough decanting step to separate hydrocarbons from water which is to be recycled; however, no indirect heat exchangers are used for recycle water, thereby avoiding clogging. The gas recovered from the first cooling stage is at about the water dew point of the gas, and is then cooled in a second stage in direct contact with refrigerated water, but because the fouling substances of the gas are removed in the first stage, there is no clogging problem when the recycle water is cooled in an indirect heat exchanger with an external refrigerant.

**20988 Petrochemical refinery Burghausen. Reversal and expansion of the ethylene production of the German Marathon Petroleum GmbH in Burghausen.** Spindler, M. (Deutsche Marathon Petroleum G.m.b.H., Burghausen (Germany, F.R.). Werk Burghausen). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **30**: No. 8, 364-365(Aug 1977). (In German).

The modification programme of the Deutsche Marathon GmbH for the petrochemical refinery at Burghausen was completed last year. The object of these modifications is to improve the economy. Technical aspects of the enlarged plant.

**20989 Simulation of product distributions from pyrolysis of normal and branched alkane mixtures over a wide range of conversions.** Arai, Y.; Murata, M.; Tanaka, S.; Saito, S. (Tohoku Univ, Sendai, Jpn). *J. Chem. Eng. Jpn.;* **10**: No. 4, 303-307(Aug 1977).

Three normal and branched alkane mixtures: n-pentane+n-hexane+n-heptane, 2-methylbutane+2-methylpentane+2-methylhexane, and 2-methylbutane+n-pentane+2-methylpentane+n-hexane+2-methylhexane+n-heptane were pyrolyzed at 700 C under atmospheric pressure. The alkane mixtures were diluted by nitrogen so as to give almost the same partial pressure for each component as that in the commercial cracking of naphtha, and the product distributions over a wide range of conversions are presented. A simulation model for the product distribution is applied to the pyrolysis of alkane mixtures by taking into account the interaction between coexisting components. It is found by comparing with the experimental results that the present simulation model can be applied to simulate the product distributions over a wide range of conversions for normal and branched alkane mixtures. 12 refs.

**20990 Turbo proposes new refinery concept.** *Energy Process./Can.;* **69**: No. 6, 40-42, 44-46(1977).

This article features Turbo Resources Ltd.'s proposed 100,000 b/d refinery to be built near Edmonton, which will allow the company to advance its waste oil refining technology into modern vacuum distillation hydrotreating. The Turbo Lubrefinery Project, as it is known, will produce recycled lube oils, motor gasoline and net crude oil products as well as benzene toluene naphtha feedstock

to support a world-scale benzene plant to be built by others on a separate site. The facility's processing scheme and process design are detailed.

**20991 Simplified calculation of rectification column minimum reflux conditions.** Rzabekov, I.N. (Az SSR Inst of Pet and Chem im. M. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 50-52(1977). (In Russian).

Based on the concept of a producing component, a somewhat simpler approach to the calculation of compositions of maximum concentration regions of minimum reflux conditions, for cases of the so-called second classes of fractionation, is described. The well-known A. Underwood's formula for deriving calculation expressions used in determining concentrations of components in the maximum concentration regions of the strengthening and distillation sections of a column is brought into play. Comparative calculations made in accordance with these formulas and in accordance with previously known relations show a quite satisfactory correlation.

**20992 Investigation of the operation of a gas separation unit of a catalytic reforming installation.** Sergeev, A.D.; Telyakov, E.Sh.; Matyushko, B.N.; Rezvanov, V.I. (Saratov Polytech Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 53-57(1977). (In Russian).

Results of a study of a gas separation unit of the catalytic reforming installation L-35/II-300 at the Saratov Oil Refinery are presented. Investigation of the operation of a gas fractionating absorber and a stabilization column was carried out on a mathematical model by means of an M-222 computer. The effect of distribution unstable catalyzate feeding, of using gases from hydraulic refining for processing, and of the temperature of absorption on the operation of a gas fractionating absorber is investigated. Recommendations are given on increasing the content of propane in a stable head.

**20993 Aerodynamic method for monitoring particle size distribution of microbead catalysts.** Zaitsev, V.A.; Poezd, D.F.; Vorob'eva, V.N.; Legoshina, Z.A.; Mis'ko, O.M. (All-Union Sci-Res Inst for Pet Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 917-920(1976).

Modern commercial microbead and powdered cracking catalysts have particle sizes ranging from 10 to 200 μm, including 60-80% (by mass) particles finer than 50 μm. In the process of cracking, the original particle size distribution of the catalyst changes significantly as a result of abrasion, typically with an increase in the relative content of fine particles (finer than 50 μm). This situation creates a need for performing analyses of catalyst composition. The most important work in ths direction is related to the determination of the content of fine fractions in the catalyst and the change in this content during the process of cracking. There are a number of methods available for the dispersometric analysis of dusts and powdered materials (sieve, sedimentation, hydrodynamic, aerodynamic). In the present article, the authors describe an aerodynamic method developed for analyzing catalyst composition. The principle of this method consists of a stagewise aerodynamic elutriation of the fine particles of the catalyst sample in a tube. This type of method can give results sufficiently precise for comparisons of quality among catalyst specimens of the same type. The results from the measurement of catalyst particle size distribution are listed. A comparison has been made of the results of catalyst analysis using the above-described procedure and a sieve procedure; it has been found that the proposed method can give highly accurate results in determining the particle size distribution and that it will provide information (as the sieve method will not) on the contents of particles finer than 10, 20, 30, and 50 μm. 4 refs.

**20994 Corrosion control and selection of materials for refinery equipment.** D'yakov, V.G.; Shreider, A.V. *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 926-936(1976).

This review consists of a review of the sources, forms, and rates of corrosive damage to equipment of the most important units in modern petroleum refining, along with recommendations for the most effective means for reducing corrosion losses. The following topics are covered--(1) principal aggressive components of process media in refineries, types of corrosion, and specifics of corrosive attack; (2) equipment corrosion control in primary crude oil processing; (3) chemical and engineering measures for corrosion prevention and retardation; (4) corrosion control of equipment in high-temperature destructive processes; (5) trends in corrosion control in petroleum refineries; (6) general conclusions. 26 refs.

**20995 Selection of location for removal of heat of absorption in a tower.** Turevskii, E.N.; Gorechenkov, V.G.; Aleksandrov, I.A.; Fishman, L.L. *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 937-939(1976).

This paper is concerned with the thermodynamic efficiency of an absorber/desorber system in petroleum refineries. The usual approach to the optimization of the process is based on an analysis of the relations linking an integral characteristic of the process; i.e., the recovery of the desired components, and such parameters as the absorbent circulation ratio in the system, the ratio of number of trays in absorber and desorber, the heat consumed in desorption, and the average absorption temperature. However, these relations do not exhaust all the conditions of optimization, since the recovery of desired components depends substantially on the locations of the zones from which heat is removed, i.e., the vertical positions of these zones in the tower. In this connection, an attempt has been made to investigate this problem by mathematical simulation on the basis of an algorithm for thermodynamic calculation of the absorption process, realized in a computer. In this study, 11 calculations were performed for each regime in a Minsk-22 computer. The principal conclusion from this study is that there is in fact an optimal location (relative to vertical position in tower) for removing the heat of absorption. The selection of this site is determined by many factors--pressure, temperature, compositions of gas and absorbent, required degree of recovery, and number of intermediate chillers.

## PRODUCTS AND BY-PRODUCTS

*REFER ALSO TO CITATION(S) 20989, 20990, 21018, 21042, 21050, 21734, 21982*

**20996 Distillate fuel containing dehazing compositions.** Bessler, D.U.; Tacchi, K.J. (to Petrolite Corp.). US Patent 4,046,521. 6 Sep 1977. Filed date 31 Mar 1975. 8p.

This invention relates to compositions which are the reaction products of phenol-formaldehyde resins, α-olefins epoxides derived from α-olefins of 4 or more carbons and alkylene oxides such as ethylene and propylene oxides; and to the use of these compositions as dehazers for petroleum distillates.

**20997 Combination thermal cracking and coking process.** Stolfa, F. (to UOP Inc.). US Patent 4,040,943. 9 Aug 1977. Filed date 30 Jun 1976. 4p.

A combination thermal cracker and coker for making specialty coke which permits high combined feed ratios necessary for total conversion to normally gaseous hydrocarbons, gasoline and coke without overloading the coke chamber with vapors is described. The process permits the use of smaller diameter coke chambers and/or lower pressure coke chambers.

**20998 Effect of polymeric additives and viscous oil components on varnish-forming properties of all-season oils.** Papok, K.K.; Romanova, T.V.; Kuliev, R.Sh.; Shirinov, Kh.D.; Popova, S.S.; Abasova, T.M. (Az SSR Inst of Pet and Chem im. Azizbekov). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 39-42(1977). (In Russian).

Varnish-forming properties of oil bases, obtained by various refining methods, as well as the effect of polymeric additives and viscous oil components of MS-20, and alkylaromatic oils M-14 and M-30 on varnish-forming properties of all-season oils based on No.4 oil, obtained by selective refining with subsequent hydrorefining, are investigated. It is found that the oil base obtained by selective refining with subsequent hydrorefining exhibits the least tendency to varnish formation. All polymeric additives and oil components increase the tendency of oil towards varnish formation within the temperature range of 250-330C, and the more so, the higher the temperature.

**20999 Investigation of the effect of pressure on the composition of binary azeotropes, aromatic hydrocarbon $C_9$—isobutyl alcohol.** Smirnova, L.A.; L'vova, A.I.; Lipkin, G.M. (Moscow Inst Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 43-45(1977). (In Russian).

The effect of pressure on the composition of binary azeotropes, m-xylene-isobutyl alcohol, n-xylene-isobutyl alcohol, ethylbenzene-isobutyl alcohol, is experimentally investigated. The results obtained make it possible to work out a technology of regeneration of isobutyl alcohol after its utilization in the process of azeotropic rectification for the separation of pure o-xylene from its mixture with isomers of xylene and ethylbenzene.

**21000 Effectiveness of smoke suppression additives for diesel fuels.** Malyavinskii, L.V.; Rossinskii, V.M. *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 875-877(1976).

One of the most economical and promising methods for reducing carbon (soot) formation and pollution of the environment by transport diesels is the use of special smoke suppression additives. This paper presents results of an investigation in which by means of a procedure developed at VNII NP [All-Union Scientific-Research Institute for Petroleum Processing], the effectiveness of the additive IKhP-706 of the Institute of Chemistry and Additives of the Azerbaidzhan SSR has been rated and compared with that of the additives ECA-5222 and Paradyne 12, which are produced by Esso. The smoke index of the exhaust gases was determined on the scale of the sensing galvanometer of a Hartridge smoke meter in accordance with the operating instructions for the instrument and the standard

GOST 19025-73. The antismoke effect of the additive (A$sub e$) was calculated from the formula A$sub e$=(K$sub bf$-K$sub ad$/K$sub bf$)/100%, where K$sub bf$ is the smoke index of the exhaust gas when operating on the base fuel; K$sub ad$ is the smoke index of the exhaust gas when operating on the fuel with additive. It is concluded from experimental data, that regardless of the engine model used in testing, the USSR additive IKhP-706, when used in Grade A diesel fuel, has a higher smoke suppression effect than the Esso additives ECA-5222 and Paradyne 12. 4 refs.

**21001 High-v.i. lubricating oil produced by adsorptive treatment of heavy catalytic gas oil.** Alekhina, N.I.; Mikhailov, I.A.; Levinson, S.Z.; Melik-Akhnazarov, T.Kh.; Agafonov, A.V. (All-Union Sci-Res Inst for Pet Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 910-913(1976).

In recent years, major attention has been directed toward the utilization of heavy catalytically cracked gas oil (CGO) as a raw material for lube oil production. Studies in this area have demonstrated the feasibility of using such raw material to produce lube oils with high viscosity indices and good thermal-oxidative stability. The work reported in this paper was devoted to the production of lube oils from CGO by adsorptive treatment with a moving bed of adsorbent, this process having been commercialized. The aluminosilicate adsorbent is a highly active agent for the removal of undesirable resinous and sulfur compounds from the CGO, along with polycyclic aromatic hydrocarbons. The feedstocks used in this work were gas oils produced by cracking a heavy distillate feedstock (from mixed Eastern medium-sulfur crudes) over amorphous and zeolitic microbead aluminosilicate catalysts at moderate cracking temperatures (fuel regime). The physicochemical properties and chemcal group composition of the CGO samples are listed. The adsorption treatment was performed in laboratory and pilot units using a commercial aluminosilicate microbead adsorbent. The desorbed oils can be used as heat transfer fluids, plasticizers, and softening agents for compounded rubbers, as well as in the production of carbon black and petrochemicals. 7 refs.

**21002 Production of paving asphalts from high-wax crudes in fuel-profile refineries.** Grudnikov, I.B. (Bashkir Sci-Res Inst for Pet Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 914-916(1976).

High-wax crude oils are not currently used for the production of paving asphalts in fuel-profile refineries. The only potential raw materials for asphalt production in such refineries are residua that give oxidized asphalts with unsatisfactory ductility. The production of straight-reduced asphalts is likewise unfeasible, as no high-vacuum equipment is available. The main reason for the unsatisfactory ductility of asphalts produced by oxidizing high-wax residual stocks is the relatively low content of aromatic hydrocarbons in the final product. The technology of asphalt production in fuel-profile refineries includes consecutive operations of vacuum distillation and oxidation. In this paper the author presents results from an investigation in which the normal sequence of operations for asphalt production was reversed--i.e., the distillation was preceded by oxidation. This approach was predicated on the theory that preliminary oxidation of the feedstock would tend to convert the aromatic hydrocarbons to higher-boiling compounds that would be retained to a greater degree in the subsequent distillation. This should result in asphalts with higher contents of aromatic hydrocarbons and hence in asphalts with higher ductility. Extensive experimental data are presented and discussed. It has been demonstrated that the proposed production scheme can provide an expansion of raw material resources for producing standard asphalts, through the use of high-wax crudes containing up to 8% solid paraffins by weight, these materials having been considered unsuitable for asphalt production. 6 refs.

## MARKETING AND ECONOMICS

*REFER ALSO TO CITATION(S) 21035*

**21003** (CONF-770375—, pp 147-151) **LPG/energy-value relationships.** Culberson, S.F. 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

The declining production of oil and natural gas is a change of great significance to the gas processing industry. These production declines are having, and will have, a major impact on domestic LPG supplies, and will lead to sharply increased imports of propane and butanes. These imports will present some opportunities and could cause some problems in your business. The various methods of forecasting LPG imports and LPG energy value relationships are discussed. The discussions are limited to propane and butanes and cover traditional market forecasting procedures, and secondly an alternative, systematic procedure developed by Pace which considers competing fuels. Price forecasts built on this latter approach are then presented. (JRD)

**21004 Brief review of activities of the Yugoslav petroleum industry in 1976.** Antic, S.; Boranic, V.; Brajcic, V.; Bogdanovic, M.; Hill, Z.; Ibrahimpasic, I.; Jovanovic, M.; Lesic, A.; Mladenovic, M.; Nikolic, D.; Protic, R.; Rajkovic, D.; Stelcer, J. *Nafta (Zagreb);* **28**: No. 6, 367-380(Jun 1977). (in Serbo-Croatian).

A review is presented of oil and gas prospecting and production in Yugoslavia, and a brief outline is given of activities of Yugoslavia companies abroad. Further, data on performed drilling activity, oil refining and consumption of petroleum derivatives are presented. Also discussed are the Yugoslav market for petroleum derivatives and gas in 1976, the price structure of some typical petroleum derivatives, and transportation, storage and handling of oil, its derivaties, and gas.

## WASTE MANAGEMENT

**21005 Method of converting oil and waste containing sludge to dry waste.** Fowler, L.L. US Patent 4,059,666. 22 Nov 1977. Filed date 17 Apr 1975. 4p.

This disclosure is a method of converting oil and water containing sludge to dry waste in a plurality of steps as follows: 1. Adding to the sludge a petrophylic material to absorb the oil and to separate out the water which is permitted to drain. 2. Adding fibrous material for strength to bond the petrophylic material. 3. Having drained the excess water from the sludge, add hydrophylic material to absorb any of the water which may be intermixed. 4. Sealing the external surface of the substantially dry material.

**21006 Laundering of oil base mud cuttings.** Mondshine, T.C. (to NL Industries, Inc.). US Patent 4,040,866. 9 Aug 1977. Filed date 15 Jan 1976. 4p.

A process for removing oil base mud adhering to cuttings obtained in well drilling operations is claimed comprising contacting the cuttings with a solvent consisting essentially of a mixture of ethyleneglycol monoisobutyl ether, diethyleneglycol monobutyl ether acetate, ethyl butyl ketone, ethyleneglycol monobutyl ether, ethyleneglycol monomethyl ether acetate, diethyleneglycol diethyl ether, and diethyleneglycol mono-n-hexyl ether, together with paraffin oil, in relative proportions of from 10:90 to 80:20. This forms a mixture of oil and solvent on the cuttings which is readily removable; as by washing or centrifuging or a combination of the two.

**21007 Problem of determination of nitrogen oxides.** Gorbanenko, A.D.; Krutiev, V.A. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 74-75(Feb 1977). (In Russian).

In order to check various materials used in the manufacture of nitrogen oxide samplers, tests were carried out on a setup with a combustion chamber made of quartz glass. Uncooled samplers made of carbon steel, stainless steel, and quartz glass, and water-cooled samples made of stainless steel, brass, and quartz glass were tested. Nitrogen oxide measurements were carried out by the chemical method. Kerosene was used as fuel. It is concluded that uncooled samples made of stainless or carbon steel may be used at the temperatures of 700-750 C. At 900-950 C stainless steel samplers may be used.

**21008 Kinetics of biochemical oxidation of refinery wastewaters.** Gerber, V.Ya.; sharafutdinov, V.M.; Gerchikov, A.Ya. (Bashkir Sci-Res Inst for Pet Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 826-832(1976).

In treating wastewaters from petroleum refineries and petrochemical plants, ever-increasing use is being made of biochemical oxidation in aerotanks (aeration tanks). In a number of cases, however, the process of treating in aerotanks does not proceed in an efficient manner, so that unduly large treating facilities are required, with correspondingly high air consumption rates and excessive costs of treating. The biochemical treating process in aerotanks is designed on the basis of the theories of chemical reactors, mass transfer, and kinetics of biochemical oxidation. Here the greatest difficulties are encountered in dealing with the kinetics of conversion of organic substances. This paper presents results from a study of oxygen consumption rates in biochemical oxidation of refinery wastewaters, these results being used as the basis for selecting a type of kinetic model to describe the process. The material selected for these biochemical oxidation studies was a mixed stream of refinery and petrochemical plant wastes as received at plant biochemical treating facilities. This mixed waste stream, after preliminary filtration, was used in the kinetic experiments. A kinetic equation has been derived which describes the specific rate of oxygen consumption in the biochemical oxidation of wastewaters, gives satisfactory agreement with experimental data obtained in the oxidation of a mixed refinery and petrochemical plant waste stream. This demonstrates the feasibility of using this proposed equation to describe the rate of biochemical oxidation of contaminants in refinery wastewaters. 8 refs.

**21009 Use of technical oxygen for biochemical treatment of refinery wastewaters.** Gerber, V.Ya.; Gubanova, G.D.; Ioakimis, E.G. (Bashkir Sci-Res Inst for Pet Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11-12, 832-836(1976).

Results of an experimental program are presented in which oxygen was substituted for air in biochemical treatment of refinery wastewater in laboratory aerotanks. The laboratory unit operated around the clock, at room temperature. In the course of these studies, three basic groups of refinery wastewaters were subjected to treatment: industrial drain and runoff water (sewer system I), waste from a ELOU [electric desalting unit], and a mixed refinery and petrochemical plant waste stream, representing a mixture of oil-containing wastewater from a refinery and contaminated waste streams from the production of synthetic fatty acids and synthetic alcohol. Technological and economic advantages of replacement of air by oxygen in biochemical treatment of refinery effluents are discussed. 8 refs.

**21010 Experience in operating biological treating facilities of Angarsk Petrochemical Combine.** Elkin, V.M.; Skripkin, O.N.; Faleeva, O.I.; Imanov, E.G. (Angarsk Petrochem Combine, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 836-838(1976).

This paper describes the biological treating facilities in one of Russian petroleum refineries designed for effluent purification. Wastewaters enter the treating facilities from refinery electrodesalting units, from chemical production operations, and from the municipal sewer system. The averaged composition of the waste stream is shown. The results obtained in wastewater treating during 1974 are presented in table. With increasing content of surfactants in the mixed wastes, the quality of activated sludge in the aerotank decreases, the oxygen regime becomes poorer, and the effectiveness of treatment drops off. Experiments have been performed to determine the influence of Solvar on the biological treatment of the wastewaters. It has been established that contents of Solvar up to 5 mg/liter in the mixed water do not affect the biological treatment of the wastewaters.

**21011 Treatment of wastewaters from succinimide additive production unit at Perm' Petroleum Refinery.** Vasilenko, G.D.; Tikhonruk, I.F.; Sin'kovskaya, Z.A.; Stomov, A.S. (All-Union Sci-Res and Des Inst of the Pet Refin and Petrochem Ind, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 838-840(1976).

In manufacturing additives of the succinimide type a waste stream is formed, contaminated with such components of the synthesis as diethylenetriamine (DETA), maleic anhydride, and xylene. In the reported investigation, a determination was made of the toxicity of the succinimide additive production waste at the Perm' Petroleum Refinery. This was done through a laboratory study of the influence of this particular effluent on the dynamics of drop in chemical oxygen demand of the wastewater, on the processes of ammonification and nitrification, and on the growth and development of saprophytic microflora. In these studies, particular attention was given to the influence of DETA on the microorganisms active in the biochemical treatment of the wastewater. It was found that DETA concentrations on the order of 5-25 mg/liter are not toxic for the bacteria of the activated sludge. The growth rates of these bacteria are dependent on the concentration of DETA in the test fluid. In conclusion, the studies have shown that the succinimide additive production waste, when combined with the general waste from the Perm' refinery, with DETA concentrations from 15 to 25 mg/liter, is toxic for protozoan species of the activated sludge in the biological treating facilities of the refinery. The waste from production of succinimide-type additives can be fed into the common biochemical treating facilities with an initial DETA concentration no greater than 5 mg/liter. As the microflora becomes adapted to the activated sludge (8-9 days), the DETA concentration may be increased to 10 mg/liter. 2 refs.

**21012 Use of ozone in treatment and aftertreatment of refinery wastewaters.** Sharifov, R.R. (All-Union Sci-Res Inst of Water Supply and Sewage Syst, Hydrotech Fac, and Eng Hydrogeol, USSR ). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 842-845(1976).

The composition of refinery production wastewaters is extremely diverse, depending on the quality of crude oil being processed and the technology of crude pretreatment. Currently used mechanical and physicochemical methods cannot give adequate removal of crude and oily products from industrial wastewaters. In most cases, biologically treated effluents to be discharged to water reservoirs or watercourses will also require aftertreatment in order to meet the maximum allowable standards for concentration of pollutants. One such aftertreatment is the ozonization of refinery wastewaters. These studies were undertaken to identify more precisely the mechanism of purification of oil-containing wastewaters by means of oxidation with ozone, this ozone having been synthesized from atmospheric oxygen under the influence of a silent electric discharge. Experimental data are tabulated and evaluated. The possibility of obtaining ozone directly from atmospheric oxygen in the treating station, the high reactivity and strong bactericidal action of the ozone, and the absence of any residual ozone in the water after treatment--all these factors make ozone a most promising reagent for treatment and aftertreatment of refinery wastewaters. 6 refs.

**21013 Experience in local treatment of wastewaters from petrochemical production.** Amosov, V.V.; Zilberman, A.G.; Kucheryavykh, E.I.; Sorkin, E.I.; Tsarik, L.Ya.; Eppel', S.A.; Timoshek, V.E.; Titov, I.P. (Zhdanov Irkutsk State Univ, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 850-852(1976).

This report describes two wastewater treatment plants in the Russian petroleum and petrochemical industries--(1) treatment of sulfide-containing wastewaters, and (2) treatment of wastewaters from PS production. In the course of refining crude oil, the wastewaters that are formed may contain hydrogen sulfide, sodium and ammonium sulfides, and phenols. The total quantity of sulfur compounds may vary from 0.5 to 10 g/liter. Various methods are used to detoxify such wastewaters, the main methods being desorption and oxidation of the sulfur compounds. This paper describes a new process and equipment, which has been tested in pilot plant studies, in which catalytic oxidation has been used. The wastewaters formed in the manufacture of polystyrene foam and high-impact polystyrene contain organic components such as polyvinyl alcohol, styrene, and polystyrene, and also inorganic ions such as $Ca^{2+}$, $Mg^{2+}$, $PO_4^{3-}$, and $Cl^-$. The treatment of such wastes is accomplished in a local unit by a coagulation/flocculation method. Various methods (coagulation, froth flotation, and electrocoagulation) were examined and tested in pilot plants, and compared with each other. 6 refs.

**21014 Experience in the use of polyurethane foam as a filter material in treating oil-containing wastewaters.** Oboznyi, V.F.; Pichakhchi, I.D.; Shimkovich, V.V. (All-Union Sci-Res Inst for Water Conserv, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 853-856(1976).

This paper is concerned with the use of flexible polyurethane foams in treating water to remove crude oil and petroleum products. Interest in polyurethane foam stems from the search for new effective filter materials to replace the quartz sand filters and flotation units presently used to treat oil-containing wastewaters in petroleum refineries. Studies conducted at the All-Union Scientific-Research Institute for Water Conservation (VNIIVO) have established that the absorption capacity of polyurethane foams for various petroleum products is 0.7-0.95 g/cm$sup 3$. This report presents results of laboratory studies which were performed on an artificially prepared mixture of water, petroleum products, and solid contaminants. The petroleum products used in this work were represented by a mixture of avtol [motor oil base stock] and diesel fuel, as well as light fractions (kerosine and gasoline). The laboratory unit consisted of a filter column with a height of 3 m and a diameter of 0.1 m. The filter was charged with flakes of polyurethane foam. The experimental data obtained in these laboratory studies provided a basis for assessing the effectiveness of the wastewater treatment, the length of the filter cycles, the filter head loss, and the filtration rate. An experimental unit was designed for a throughput of 400 m$sup 3$/h and was installed and tested. Results are given. 5 refs.

**21015 Treatment of waste streams from catalyst manufacturing plants in refineries.** Blagodarnaya, L.F.; Dyuzhakin, M.G. (Novokuibyshevsk Petrochem Combine, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 856-858(1976).

The waste streams from catalyst manufacturing plants in refineries are classed as nominally "clear" streams and are discharged to reservoirs or watercourses without any treatment whatever. A survey conducted at the Novokuibyshevsk Petrochemical Combine has shown that these waste streams are rather highly contaminated with suspended matter, petroleum products, and dissolved inorganic impurities. Results from this survey are tabulated. The analytical data and the information obtained on operating conditions confirm the need for local treatment of the entire effluent from this unit to remove oils and suspended matter. Some suggestions are given of two possible routes for treating these waste streams which should be followed to obtain wastewater suitable for free discharge.

**21016 Concentrating waste streams from electric desalting units by means of contact evaporators.** Kostyuk, V.I.; Vilkov, G.I.; Cherednichenko, G.I.; Khodak, V.D.; Krasutskii, G.A.; Koposov, V.N.; Karnaukh, G.S.; Yampol'skii, N.G.; Kal'chenko, V.I.; Sirotkin, L.M.; Udovenko, I.A.; Paizenko, M.I.; Olefir, N.A.; Razdaibedin, A.S. (All-Union Sci-Res and Des Inst of the Pet Refin and Petrochem Ind, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 859-862(1976).

As a result of a comprehensive research program on elimination and combined processing of saline waste streams from petroleum refineries, a unit for disposal of these wastewaters has been built at the Lisichansk Petroleum Refinery. However, the cost of eliminating 1 m$sup 3$ of waste is still high, with about 50% of the total operating costs being attributed to the expensive steam from the

steam/electric power station that is required by the unit. Any curtailment of this steam consumpiton would have a substantial effect on the process economics. One of the possible types of apparatus for concentrating the initial saline wastes from refineries is the contact evaporator, in which the evaporation is accomplished by direct contact of the waste stream with a heat carrier. The elimination of fixed heat-transfer surfaces removes the threat of scale formation and makes it possible to carry out the evaporation of the wastes under positive pressure and to obtain process steam for refinery use. This paper describes the design and operation of the developed contact evaporator and presents results obtained with it in industrial applications. It is demonstrated that the inclusion of a contact evaporator unit in the flow plan for combination vacuum processing of saline wastes from refineries can provide very substantial reductions in total costs for wastewater disposal. 5 refs.

**21017 Disposal of petroleum sludges.** Bibikov, G.G.; Nemchenko, A.G.; Galutkina, K.A.; Apostolova, I.V.; Karazeeva, L.P. (All-Union Sci-Res Inst of Petrochem Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 862-866(1976).

The petroleum sludges that are formed in refineries and in petrochemical combines (up to 1% of the crude oil processed) are generally hydrotransported to specially designed oil sludge accumulators (holding ponds), where three layers are formed by settling: a top layer of petroleum products, a middle layer of water, and a bottom layer of sediment. The water that has settled out is returned to the treating facilities; the petroleum products should be collected by means of oil collecting devices and returned for processing. However, operating experience has shown that the collection of the petroleum products from a large surface is a difficult task. The most effective approach is the use of specially designed enclosed oil-sludge separators, settling tanks of the horizontal or radial hydrocyclones, and centrifuges with mechanical removal of the bottom sediment, which should be directed at once to a burning operation. In this article, the authors present results from a study of the composition and properties of the petroleum sludges from the Kirishi Petroleum Refinery and the Salavat Petrochemical Combine. As a result of the investigation reported, a flow plan for the collection, separation, and thermal disposal of petroleum sludges has been drawn up for the design of a commercial unit. 3 refs.

**21018 Gas chromatographic method for determination of content of petroleum sulfones in wastewaters.** Kochetkova, R.P.; Eppel', S.A.; Sidorov, R.I.; Kolinsyk, G.P. (INUS, Angarsk, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 878-879(1976).

Sulfones obtained from the sulfur compounds of petroleum are currently being used as solvents and surfactants, and are also effective as veterinary medicines. In the production of sulfones (by oxidation of the sulfur compounds of petroleum with hydrogen peroxide) and in their use, the wastewaters that are formed also contain sulfones. In order to account for these losses, and also to monitor the discharge of contaminated wastewaters to watercourses and reservoirs, a spectroscopic method of determination has been developed. It includes an extraction of the sulfones from the water with chloroform, evaporation of the chloroform, and subsequent study of the sulfone spectra in carbon tetrachloride. This analysis is very laborious and time-consuming and cannot be guaranteed error-free when the wastewaters contain other nonvolatile components. In this article the authors describe a gas chromatographic method that has been developed to meet the requirements imposed on the determination of sulfones in water, without requiring any pretreatment of the sample. Procedural details are given and results from check on method are included. 4 refs.

## ENVIRONMENTAL ASPECTS

*REFER ALSO TO CITATION(S) 21051, 21052, 21053, 22211, 22269, 22270, 22271, 22273, 22274, 22275*

**21019 (PB—270418) The METULA oil spill.** (National Oceanic and Atmospheric Administration, Boulder, Colo. (USA)). Sep 1976. 342p. NTIS PC A15/MF A01.

In August 1974 the supertanker METULA ran aground in the Strait of Magellan and spilled over 50,000 tons of light Arabian crude oil. The spill was not contained and the oil was was carried over large segments of beaches and tidal marshes of Tierra del Fuego, and deep into the estuaries of the area. Findings of a team of scientists from the United States and Chile, who investigated the environmental damage in August 1974 and again in January 1975, and of others who discussed the spill at a workshop, are summarized. Included are the background of the accident, the physical environment, the reasons why cleanup measures were not attempted, and the most important follow-up research needs. The research results will be used to identify critical environmental information that can be transferred for use in planning and for predicting environmental impacts in other similar areas of the world.

**21020 1975 conference on prevention and control of oil pollution.** Washington, DC; American Petroleum Inst. (1975). 616p. (CONF-750386—).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

Papers dealing with control of oil pollution are presented in groups under legal aspects, personnel training, monitoring, prevention, cleanup, contingency plans, equipment, and effects. A separate abstract was prepared for each paper. (JRD)

**21021 Offshore oil pollution: law and enforcement.** Jackson, R.D. Jr. (Oil Insurance Ltd., Hamilton, Bermuda). pp 3-10 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

The Torrey Canyon (1967) and Santa Barbara (1969) occurrences dramatized the unique nature of offshore oil pollution risks and the lack of a definitive legal system for dealing effectively with prevention, cleanup, and compensation. Although it is not the major part of the far more serious problem of marine pollution and is caused mainly by land-sourced activity, offshore oil pollution constitutes an increasingly important hazard because of the expanded, accelerating offshore search for alternate petroleum sources and unparalleled technological innovation. As offshore petroleum activity is essentially a transplant of land-based activity to a marine environment, the law of the sea and certain traditional legal principles are in an evolutionary process of adaptation to new factual situations. Considerable progress has occurred during the last two decades, but law and enforcement at international and regional levels are still not effective, while national regimes in the context of increasing nationalization of the sea by coastal states are in danger of becoming chaotically inconsistent. Two approaches hold realistic promise: first, industry's voluntary programs, which are impressive in scope and efficiency; secondly, joint government/industry consultation, cooperation, and action, which accentuates the strengths and minimizes the weaknesses of the only two parties capable of protecting and advancing the public interest and encourages more effective law and enforcement.

**21022 1973 IMCO convention: a tanker operator's viewpoint.** Gray, W.O. (Exxon Corp., New York). pp 15-21 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

The International Convention for the Prevention of Pollution from Ships, 1973, drafted in London under IMCO auspices last fall is undoubtedly the most comprehensive and potentially promising step yet taken to prevent pollution to the seas by ships. While this convention is now open for ratification by nations, its very detailed nature has already caused studies to commence to identify the steps which must be taken to assure its practical and timely implementation. First the essential provisions of the convention, stressing the technological elements relating to oil tankers, are reviewed. These elements include ships' operational and equipment features, as well as fundamental design changes for new tankers ordered after December 31, 1975. In addition, questions of reception facilities ashore will be considered. A status report is included in regard to each of these matters as of the date of this conference. While Exxon studies on this subject must form the basis of the paper, to the extent possible, activities of various industry groups and governments toward bringing the IMCO 1973 convention effectively into force are covered as well.

**21023 Oil pollution of inland waters in England and Wales.** Toms, R. (Wessex Water Authority, Bristol, England). pp 23-28 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

The setting up of ten regional water authorities in England and Wales with the duty of managing water, from the supply of drinking water to the treatment of sewage and the control of rivers, is described. The new Control of Pollution Act 1974 is examined, particularly with regard to the powers it contains for the water authorities to take action if oil pollution occurs. This includes both action to stop discharges containing oil and also to remove oil once it has entered a river. Results of a survey to assess what are the main causes of oil pollution are discussed along with suggested means of reducing these. A description is given of a number of particularly significant cases of oil pollution and the steps taken to prevent recurrences.

**21024 Federal regulatory control of oil spill removal methods.** Synder, H.J. Jr. (Environmental Protection Agency, Washington,

DC). pp 33-37 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

The development of federal regulatory controls for oil removal methods is traced from the concerns that were developed over the use of dispersants during the Torrey Canyon incident. The evolution of annexes for chemical use control in the National Contingency Plan is described starting with the 1968 plan to the 1974 version being prepared for publication by the Council on Environmental Quality. Chemical and biological agent data requirements being included in the 1974 version are explained with emphasis on the rationale for selecting the type of data being requested. Possible directions for future federal regulatory control for removal methods are discussed.

**21025 Analysis of oil spill accidents for environmental impact statements.** Beyaert, B. (Standard Oil Co. of California, San Francisco). pp 39-45 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Environmental impact statements (EISs) are often required under the National Environmental Policy Act or similar state laws for proposed activities such as petroleum exploration and production or for new oil transportation facilities such as marine terminals and pipelines. One of the critical concerns which must be properly addressed in an EIS for such activities or facilities is the risk of an accidental oil spill and the environmental impact which would result. A comprehensive approach to analysis of oil spill accidents in such EISs is described. It identifies sources of relevant data and technical information while also pointing out areas where knowledge is incomplete. Techniques are recommended for determining the probability and size of a spill, the fate of the oil, and the resulting environmental impacts. The paper is intended to serve as a useful guide for those preparing or reviewing EISs for proposed large projects which involve appreciable oil spill risks.

**21026 Determination of an oil effluent guideline for industrial discharges in the state of New Jersey: is 1 ppM realistic and obtainable.** Birns, K.F. (Dept. of Environmental Protection, Trenton). pp 47-49 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

In order to rationally control and issue permits for discharges into the state's waters, it is necessary to have a guideline or standard to compare the discharge with. Criteria are set forth for the establishment of a maximum limit of 1 ppM oil in a discharge. The state has the authority to control the effluent quality and is also empowered to prohibit any and all oil discharges. One ppM of oil can be measured and the technology to treat water to that limit does exist. The need for a 1-ppM limit is demonstrated by the deleterious effects that oil has on water quality, marine biota, and water usage.

**21027 Maryland's experience in oil spill prevention and control.** Silbermann, H.; Weber, E.C. (Water Resources Administration, Annapolis). pp 51-55 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

An existing spill prevention and response program is described utilizing staff of the state Water Resources Administration to enforce explicit oil pollution control laws and regulations, provide response to and assistance in oil spill containment and cleanup, and foster spill prevention attitudes and techniques. Special equipment designed and constructed by agency staff is detailed. Legislative history, state laws and regulations on oil spill prevention, and the Maryland oil industry are described as introduction to the spill prevention and control program itself. Using a small staff, the Maryland Water Resources Administration has established an oil spill response program complete with (a) 24-hour, seven-day-a-week response capability to spills of oil and other hazardous materials, (b) construction and development of specially equipped oil spill control units, and (c) the stockpiling throughout the state of equipment and supplies for spill containment and removal. Local fire departments, which are mostly volunteer in the state, are an essential part of the oil spill response team. Other state agencies are also involved, with the total program coordinated by an oil spill coordinator and a staff of four.

**21028 Training a cleanup response team.** Tibbetts, A.M. (Standard Oil Co. of California, San Francisco). pp 59-63 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

The training of a spilled oil cleanup response team is not an enormous, out-of-control, expensive, or excessively time-consuming undertaking. It requires five steps which, if carefully worked out and agreed to by the parties involved, can be done in four to eight hours per man. It can be completed in approximately three months for a team numbering 300 persons (less time for a smaller team). The major steps are: (1) A printed organization chart of the response team showing all job titles and who relates to whom. (2) A formal and detailed job description of each job. (3) A series of 10-15 action objectives for each man assigned to each job to reach during his training session and after the training session on his own. (4) A four-hour or two four-hour seminars for each job where all objectives are met and accomplished by every participant. Each participant should use all required training tools and techniques including projectors, pictures, models, chalkboard, actual cleanup equipment, radios, personal experience, etc. (5) A call out and a practice session where all members of the team practice their skills in the field.

**21029 Preparation of an oil spill prevention training program.** Mossteller, T.L. (Standard Oil Co. of California, San Francisco). pp 65-68 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Items associated with development of an oil spill prevention training program are discussed. Development of the training program involved feasibility studies, proposals on contents of the program, and production of the program. The result was a program which could be used with either a group or an individual in locations spread out geographically. The first section is on prevention; the second presents fundamentals of cleanup. Each section has an audio tape and a supplemental workbook. (JRD)

**21030 Oil pollution control officer training course.** Cormack, D.; Jeffery, P.G. (Warren Spring Lab., Stevenage, England). pp 69-72 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Warren Spring Laboratory (WSL) has recently run a number of training courses for oil pollution control officers. These courses are described and activities are related to the responsibilities of the officers attending and the functions of the organizations concerned with oil pollution clearance. The nature of these activities has been explored and the underlying philosophy developed. Ultimately, the aim is to equip oil pollution officers with as wide an appreciation and understanding of available techniques and practices as possible within the limits imposed by a 10-day residential course. The training program consists of lectures, films, demonstrations, and practical work in the use of proven techniques. Members are required to produce written assessments and comparisons of a number of commercially available devices. Topics include nature and source of oil spills, beach protection and cleaning, and the recovery of oil from water surfaces.

**21031 Stream preservation training.** McMillan, W.W. (General Motors Corp., Indianapolis). pp 73-74 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Training techniques vary with the type organization, the geographical location, the subject area, and the organizational involvement. Discussions are presented concerned with the control and containment training techniques evolved by a manufacturing facility, located on an inland stream, for its operating personnel. This facility, with an oil storage capacity of over 22 million liters (6 million gallons), improves its oil handling and storage abilities by providing stream preservation training for some 200 persons. (Stream preservation training denotes a positive attitude towards oil spill cleanup.) Trainees include maintenance, powerhouse, oil stores, and plant engineering personnel. The objectives are to provide background information and training in techniques needed for spill cleanup. The specific employee behavioral objectives are to make proper notification of an oil spill, to select and use the proper methods of containment and collection, and to learn on-site public relations response. Training is by lecture, including management overview, by demonstration, and by field practice, including oil removal from a test pool, communications, and small boat handling. Evaluation is designed to stress important points covered and to provide feed-back on the degree behavioral objectives are achieved.

**21032 Practical oil spill control training school.** Robinson, J. (Union Oil Co. of California, Los Angeles). pp 75-76 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

A practical oil spill control training course is described. Objectives of the training course are listed, and a tentative schedule for a one-week course is presented. The course offers basic "hands-on" training for first-line supervisors and above. The course stresses practical rather than theoretical aspects of spill control, and it will be updated and adjusted regularly to provide experience with modern equipment and techniques on a wide variety of spill situations.

**21033 Photomicrograph techniques for characterization and monitoring oily waste streams.** Churchill, R.J. (Petrolite Corp., St. Louis). pp 79-85 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Physical and chemical characteristics of waste streams influence the ease with which oil emulsifies in water and also the stability of the resulting emulsion. The interrelationships of these parameters and their impact on emulsion stability via imposed mixing energy is examined. Electrokinetic aspects of phase stability for several crude oil-in-water emulsions are presented as well as other conventional stability factors and their interrelationship. Photomicrograph techniques and how they can be utilized for in situ surveys of oily waste streams are presented. Use of this technique yields data to assess the efficacy of existing facilities for waste handling or treatment in terms of emulsion destabilization-coalescence efficiency, waste stream characterization, or troubleshooting of operational problems. By sampling and analysis at several stations in a system, more specific data can be generated. The applicability of photomicrograph techniques to provide rational design data for oil-water separation systems is given in several practical examples. Performance in the majority of oil removal devices depends to some degree on the driving force which exists to separate the two phases. For conventional gravity separators, this driving force is expressed in terms of Stoke's Law which incorporates oil droplet diameter. Oil removal efficiencies for gravity separation systems can be accurately estimated if the influent oil droplet size distribution is known. Examples of wastewater characterization for process wastewaters, tanker ballast, and storm-water runoff are given as well as their respective treatment system performance.

**21034 Multielement true boiling point gas chromatograph for monitoring oil pollution.** Davis, C.E.; Krc, A.E.; Szakasits, J.J.; Hodgson, R.L. (Shell Development Co., Deer Park, TX). pp 93-96 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

A true boiling point gas liquid chromatograph (GLC) has been designed to measure simply and conveniently GLC data for all types of petroleum streams, including crude oils and residual fuels which contain considerable portions of high-boiling materials. The instrument generates simultaneous carbon and sulfur boiling point profiles up to 538°C ($C_{43}$). A quantitative measure of the nonvolatile organic portion of the sample is achieved by backflushing and combusting the material remaining in the inlet. Thus, identification of oil pollution samples is facilitated by obtaining data on the carbon and sulfur distribution and the amount of residue in a single, rapid analysis. Under certain circumstances, the total recovery capability also permits the extent of weathering of oil pollution samples to be determined directly from the chromatographic results.

## POLICY, LEGISLATION, AND REGULATION

*REFER ALSO TO CITATION(S) 21021, 21022, 21024, 21729, 21731, 21732*

**21035** (TID—28102) **Findings and views concerning the exemption of motor gasoline from the mandatory petroleum allocation and price regulations. Final report.** (Federal Energy Administration, Washington, D.C. (USA)). Sep 1977. 236p. Dep. NTIS, PC A11/MF A01.

Gasoline prices have never reached their allowable controlled ceilings, and marketers have contended that deregulation would increase competition. In order to assure such competition, the Administration will support legislation that would protect service station dealers from arbitrary cancellation of their leases by major oil suppliers. The supply of motor gasoline is now adequate and will be adequate through 1978; additional imports coupled with market forces can offset any supply shortfall in 1979. Competition and market forces are adequate to protect consumers as long as supplies remain adequate, and it is not anticipated that exempting motor gasoline from regulation will result in inequitable prices for any class of consumer or affect the rate of unemployment, Consumer Price Index, or the GNP. Exemption may stimulate production and should not adversely affect supply. FEA is therefore proposing to the Congress the exemption of motor gasoline from the Mandatory Petroleum Allocation and Price Regulations, and a postexemption gasoline price monitoring system. (DLC)

## TRANSPORT, PIPELINES, AND HANDLING

**21036 Shape of cross section of condensate film in pipes with two-phase flow.** Ushakov, V.I. (Kursk Polytech Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 61-62(1977). (In Russian).

Formulas are derived for the determination of the shape of the cross section of the condensate film in inclined pipes with gas and liquid two-phase flows in them.

**21037 Pipeline design with consideration of the possibility of using a diluent.** Syrtlanov, R.Sh.; Abramzon, L.S.; Tugunov, P.I. (Ufa Pet Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 78-82(1977). (In Russian).

The optimum concentration of a diluent, the number of heating points, the heating temperature, and the number of pumping stations are calculated. The formulas take into account the difference between cost of separately built heating points and of such points combined with pumping stations. As the work does not take into account the dependence of the heat transfer coefficient on the heat temperature, recommendations are given on taking account of this factor when selecting the final solution. In order to take into account the flow friction heat in large-diameter and high-capacity pipelines, a formula is proposed for an approximate evaluation of the flow friction heat. A multiple and non-multiple (nonuniform) spacing of pumping stations and heating points is considered. If a number of parameters are constrained, the design equations may easily be solved by graphical and analytical methods. Generally, computers must be used.

**21038 Calculation of the time of flow of a film of a viscous petroleum product from the inner surface of railroad tank-cars.** Lur'ev, M.V.; Mikhailov, V.M. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 77-80(1977). (In Russian).

Analytical relations are presented for the calculation of the time of flow of a set proportion of the petroleum product contained in the residual film from the inner surface of the drum of a tank-car. This time corresponds to the time of delay of the tank-car for emptying after the bulk of the petroleum product is discharged, in order to reduce the losses of the petroleum product due to incomplete emptying. An example of calculation of the time of flow of a film is presented.

## PROPERTIES

*REFER ALSO TO CITATION(S) 21034, 21038, 21098, 21923, 21932*

**21039** (CONF-770375—, pp 18-25) **Experimental equilibrium ratios of a Devonian crude—natural gas system.** Wiesepape, C.F.; Kennedy, H.T.; Crawford, P.B. (Texas A and M Univ., College Station). 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

A Devonian crude oil of 40° API gravity and free of hydrogen sulfide, nitrogen, or carbon dioxide and forming no precipitates when mixed with gas at high pressures was used as the base crude. Hexane, n-pentane, n-butane, propane, ethane gas and a natural gas were added to form the desired mixture. The mixture was prepared so that it contained 20.06 percent $C_7$/sub +/ in the total system. Vapor-liquid equilibrium ratios (K-values) were determined experimentally on this Devonian crude oil—natural gas system containing 20% of the $C_7$/sub +/ or heavy fraction. The data were obtained at 150 and 350°F and several pressures. Comparisons are made between the experimental and GSA equilibrium ratios.

**21040** (CONF-770375—, pp 36-41) **Perturbed-hard-chain theory for correlation of thermodynamic properties.** Donohue, M.D.; Kaul, B.K.; Prausnitz, J.M. (Univ. of California, Berkeley). 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

The perturbed-hard-chain theory for pure fluids has been extended to mixtures. This theory adequately describes pure-component configurational properties and fluid-mixture configurational properties (K factors, Henry's constants, cross second virial coefficients and enthalpies) for a large variety of fluid mixtures commonly encountered in the petroleum, natural-gas and related industries.

**21041 Experimental investigation of the density of residual fuel oil of Tyumen deposit petroleum types.** Sorokina, B.A.; Kremenevskaya, E.A. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 89-91(Feb 1977). (In Russian).

Results of systematic investigations of thermophysical properties of residual oil of the Tyumen deposit are presented. A constant-volume cylindrical piezometer was used to determine density. The experimental setup is described and results are given in the form of a table. Densities for the temperature range of 50-250°C and the pressures from 1 to 14 MPa are given for four types of residual oil.

**21042 Experimental investigation of P-V-T dependence of cyclohexane and benzene at the melting line.** Kurumov, D.S.; Murdaev, R.M.; Grigor'ev, B.A. (Groznyi Pet Inst im. M.D. Millionshchikov, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 75-77(1977). (In Russian).

Experimental investigations are carried out concerning the specific volumes of cyclohexane and benzene within the temperature range of 5.71-77.7 MPa, including the region in the vicinity of the melting line. The error rate of the data does not exceed 0.05%. The results of the experiment are described by the Tate equation.

**21043 Distribution of nitrogen in the refining products of some types of petroleum of the subcarpathian region.** Zamulinskii, I.M. (Ivano-Frankovskii Inst of Pet and Gaz, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 51-55(1977). (In Russian).

The content of general and basic nitrogen in different fractions, obtained at different distillation temperatures from petroleums of Nos. 106 and 633 wells of Dolina and No. 648 well of Bytkov, is determined. The dependence of the content of general and basic nitrogen in distillate fractions on the extent of their take-off (in in terms of percentage of mass of petroleum) is established and empirical formulas describing this dependence are derived. It is found that the higher the take-off of distillate fractions, the higher is the proportion of petroleum nitrogen that passes into them, and the higher the content of general and basic nitrogen in the initial oil, the higher proportion of it is concentrated in the residue.

**21044 Generalized equation of state of liquid n-alkanes.** Zagoruchenko, V.A.; Guske, D.N. (Odessa Inst of Eng of the Marit Fleet, Ukr SSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 62, 108(1977). (In Russian).

Relying on a study of the regularities of change of the thermal properties of liquid n-alkanes, an equation of state is set up for the entire series, from n-hexane to n-eicosane. The equation contains 14 coefficients, common for all these substances, critical temperature, and the number of atoms in the molecule. Within the range of the reduced temperature 0.40-0.95 from the saturation pressure to 100 MPa, the root-mean-square deviation of the computed data from the experimental ones amounts to 0.2%.

**21045 Viscosity of liquid hexene-1 at high pressures.** Guseinov, S.O.; Naziev, Ya.M.; Shakhverdiev, A.N. (Az SSR Polytech Inst im. Ch. Il'dryma). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 66-68(1977). (In Russian).

Results of experimental measurements of the dynamic viscosity of liquid hexene-1 within the range of temperatures from room temperature to 200C and pressures of up to 491.5 bar are presented. The measurements were made by the falling-load method. N-heptane was used as the reference substance. A check was also made with reference to hexane and nonane. The data obtained were generalized by means of N.B. Varhaftik's equation which shows the validity of the one-valued relation $DELTA$$sub $eta$$=f($rho$), where $eta$ denotes viscosity and $rho$ density at a given pressure and temperature.

**21046 Evaluation of the information content of oil well products using the data about their structural and mechanical properties.** Gadzhiev, M.A. (Az SSR Polytech Inst im. Ch. Il'dryma). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 85-90(1977). (In Russian).

Consideration is given to the results of an investigation into the character of variation of the parameters of structural and mechanical properties (s.m.p.) of oil well products. Based on these results, boundaries of the regions of a set of random values (s.r.v.) of the parameters of the s.m.p. of borehole oil and gas mixtures are evaluated for particular deposits. The possibility of selecting a target function of distribution of the s.r.p. of the parameters of the s.m.p. of borehole oil and gas mixtures, of mathematical expectation, and intensity of their variation in a deposit is demonstrated.

**21047 Distribution of sulfur compounds in Emba and Mangyshlak crude oils.** Lobanova, G.A.; Buyanova, N.S.; Kotova, A.V.; Ben'kovskii, V.G. (Inst of Chem of Pet and Nat Salts, Acad of Sci of the Kaz SSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 899-901(1976).

This is part of a continuing systematic study dealing with the distribution of groups of organic sulfur compounds in Kazakhstan crude oils and refined products; the present work represents an investigation of the content and distribution of sulfur compounds in crudes from a number of new fields in Kazakhstan. The authors have studied the group composition of the sulfur compounds found in 29 crude oils. The crude oils from the new fields show a wide variation in properties. The total sulfur contents show this same sort of wide variation. Analytical data are tabulated and evaluated. 5 refs.

**21048 Thermogravimetric investigation of oxidative polycondensation of petroleum residual stocks.** Primak, R.G.; Bogdanov, M.V.; Bodan, A.N. (All-Union Sci-Res and Des inst of the Pet Refin and Petrochem Ind, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 920-922(1976).

In the thermal oxidation of petroleum residua, reactions of oxidation, thermal and thermal-oxidative decomposition, and polycondensation take place, as well as evaporation of components of the residuum and its decomposition products. The main process determining the rheological properties of the final product (asphalt) is the oxidative polycondensation of unsaturated structures and of aromatic and heteroatomic compounds, forming cross-linked, high-molecular-weight systems consisting of resins, asphaltenes, carbenes, and carboids. In the present work, in the example of five samples of residua obtained from crude oils produced in different fields, the authors have examined the feasibility of using TGA in studying reactions of thermal-oxidative polycondensation of petroleum residua. The TGA was performed under dynamic and isothermal conditions in a stream of air or nitrogen. The isothermal tests were run at 250°C. The viscosities of the samples heated in the TGA runs were measured in a Ferranti-Charlis viscometer at 100$degree$C. Experimental data are tabulated, plotted and discussed. 9 refs.

**21049 Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils.** Korsakova, I.S.; Shpiro, G.S. (All-Union Sci-Res Inst for Pet Process, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 944-946(1976).

Corrosion and fouling of heating surfaces by ash deposits in boiler units as a result of exposure to combustion products from medium-sulfur residual fuel oils can be reduced substantially by the use of additives. A gravimetric method was proposed for rating the corrosivity of gaseous production products on the basis of the weight loss of metal specimens. However, the accuracy of such methods is not very high, as the relative error in determining corrosion rates is somewhere around 20%. Hence, the authors have continued this work on the development of more accurate accelerated laboratory methods for rating the corrosive properties of gaseous corrosion products from residua fuel oils. In this paper they present results from studies of the combustion products from medium-sulfur fuel oils by means of an electrochemical method that, together with the gravimetric method, can be used as the basis of a procedure for preliminary evaluation of the effectiveness of anticorrosion additives. Details of the method are given. A study of the concentration dependence of effectiveness for the additives VNII NP-106 and Polyphen has shown that the relative corrosion reduction coefficient increases from 0 to 25-30% as the additive mass concentration in the fuel is increased from 0 to 1%. As a result of his work, the electrochemical method for investigating combustion products has been recommended for use in screening tests on anticorrosion additives for residual fuel oils. 5 refs.

**21050 Evaluation of reliability of results in determination of content of particular contaminant in jet fuels in accordance with GOST 10557-63.** Zrelov, V.N.; Sharapov, V.I.; Postnikova, N.G.; Krasnaya, L.V.; Marinchenko, N.I.; Boiko, L.V.; Zhuldybin, E.N. *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 951-954(1976).

At the present time, major attention is being gven to the filtration of jet fuels to remove particulate contaminants. The effectiveness of fuel cleanup methods in removng partculate contaminants is usually rated by means of a standard procedure (GOST 10577-63) that has been included in the standard for T-6 and T-7 fuels (GOST 12308-66) and in the TU [specification] for T-8 fuel, and is being used as a referee test in determining particulate contaminant in RT [thermally stable jet fuel] (GOST 16564-71). This paper critically reviews the existing methods for the determination of the content of particulate contaminant in jet fuels and outlines their shortcomings. The needs for new approach and new test techniques are outlined. 7 refs.

**21051 Determination of sulfur-containing petroleum components in marine samples.** Warner, J.S. (Battelle-Columbus Labs., OH). pp

97-101 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Sulfur-containing petroleum components such as benzothiophene, dibenzothiophene, naphthobenzothiophene, and their alkyl derivatives are obtained along with aromatic hydrocarbons during the determination of hydrocarbons in marine samples. By using a sulfur-specific flame photometric detector in gas chromatographic analysis, the sulfur-containing components are determined separately from the aromatic hydrocarbons. Individual sulfur-containing components are identified by retention times and mass spectrometry. It is shown that the fingerprint of sulfur-containing components can be more definitive of an oil source than the corresponding hydrocarbon fingerprint. It is also shown that sulfur-containing components can be preferentially concentrated in the marine environment. The techniques described have been used to identify and quantitate individual sulfur-containing compounds in marine tissue and sediment samples.

**21052 Analytical methods for polynuclear aromatic hydrocarbons in crude oils, heating oils, and marine tissues.** Pancirov, R.J.; Brown, R.A. (Exxon Research and Engineering Co., Linden, NJ). pp 103-113 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

The first phase is described of a project to demonstrate analytical methods in their ability to measure individual polynuclear aromatic hydrocarbons in typical petroleum oils and marine animal tissues. Work on marine tissues in its initial stage as an analytical method is shown to be capable of measuring benz(a)anthracene and benzo(a)pyrene when added to clams at the 5 parts per billion (ppB) level. Evaluation of results indicate a detectability of 1 ppB. Eleven to sixteen individual hydrocarbons were measured in samples of a South Louisiana crude, Kuwait crude, a No. 2 heating oil, and a Bunker C fuel. These compounds included the principal 3-to 5-ring aromatics found in petroleum and one 6-ring (benzo(ghi)perylene). The tricyclics (phenanthrene, methylphenanthrenes) were generally present in the highest concentration and covered the range 26-7677 ppM by weight. Four- and five-ring aromatics occurred in the range <0.5-240 ppM. Concentrations of the most widely studied polynuclear aromatic hydrocarbons, benzo(a)pyrene and benz(a)anthracene, were similar to one another being present at 0.6 to 2.8 ppM in the crude oils and heating oil, whereas in Bunker C their concentrations were 44 and 90 ppM, respectively. Measurements of benzo(a)pyrene by previous investigators are tabulated and compared with those of this paper. Data are also presented to show that the alkyl-substituted forms of these compounds are present at much higher concentrations than the parent compound itself.

**21053 Evaluation of some methods of analysis for petroleum hydrocarbons in marine organisms.** Farrington, J.W.; Medeiros, G.C. (Woods Hole Oceanographic Institution, MA). pp 115-121 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

Soxhlet extraction, homogenization with $Na_2SO_4$ in a Virtis homogenizer, and KOH-methanol digestion methods of extracting hydrocarbons from marine organisms have been tested and compared using subsamples of a clam (Marcenaria mercenaria) homogenate. The amounts of hydrocarbons were determined gravimetrically and the composition was partially characterized by gas chromatography. There was a statistically significant difference between the results of the Virtis vs. Soxhlet and Soxhlet vs. digestion methods. However, in practice the difference is small and would be apparent only if large numbers of replicate measurements were made. The concentration of hydrocarbons in clams from three locations, a polluted harbor area, a less polluted bay area, and a relatively clean bay have been determined. The composition was partially characterized by gas chromatography. Subsamples of clam homogenate spiked with 10 ppM API No. 2 fuel oil have been analyzed. Only 5 to 6 ppM of the spike were detected. Gas chromatographic analysis indicated that the lower molecular weight components of the spike were lost. The gas chromatographic passive tagging parameters were altered from those of the API No. 2 fuel oil by interference from hydrocarbons already present in the clams prior to spiking.

**21054** (N—77-26322) **Effect of naphthols on the thermal stability of fuels.** Oblasova, L.Z.; Kharlampovich, G.D.; Stekhun, A.I. Translated from *Neftepererab. Neftekhim. (Kiev);* No. 1, 3-4(1973). 5p. (NASA-TT-F—17302). NTIS PC A02/MF A01.

Monosubstituted alkylnaphthols in the form of alpha- and beta-isopropyl- and -isobutylnaphthols are shown to have high antioxidant properties, form homogenous phases with fuels, and be soluble in fuels. The inhibition activity of the compounds approach that of the antioxidant additive Topanol A. The thermal stability of hydrorefined aviation fuel T-7 (boiling range 140-240 deg, S content 0.002%) treated with the naphthol additives is tested in contact with Cu plates.

## STORAGE

**21055 Underground storage of oil and gas.** Claesson, A.; Bertland, H. (Skanska Cementgjuteriet, Danderyd (Sweden)). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **30**: No. 8, 357-361(Aug 1977). (In German).

Underground storage of oil and gas in bare rocks is a successfully practised method in Scandinavia. Also in other parts of the world this method is receiving increased attention. The following paper deals with this storage method and the required equipment.

**21056 Offshore terminal with underground storage at sea.** Relotius, P.C.; Lorenzen, H.; Kaundinya, H. (Meerestech und Seebau, Hamburg, Ger). *Erdoel-Erdgas Z.;* **93**: No. 7, 242-245(Jul 1977). (In German).

Bigger dimensions of tankers have prompted a feasibility study on an offshore terminal with immediate underground storage for crude oil or gas in cavities leached out from salt domes. A technical concept has been developed which provides a crude oil discharge of about 18 Mio tons/yr. Using one of the salt domes in the German part of the North Sea, a storage capacity of 10 Mio m$sup 3$ for intermediate storage and provision of reserves can be set up. Advantages of this facility, which include improved safety in coastal waters, are also discussed.

**21057 Use of concrete in the new terrastore underground storage system.** *Pet. Rev.;* **31**: No. 367, 13-14(Jul 1977).

This brief article deals with the new Terrastone underground storage system which involves the novel concept of logitudinal truncated large-size tunnel-shaped tanks located immediately below soil surface. The tanks will be constructed mostly in reinforced concrete for the safer products such as crude oil and heavy refined oils, and in post-tensioned reinforced concrete with special metal or synthetic membranes and insulations for storing LNG. The construction design and economics of the system are outlined.

## COMBUSTION

*REFER ALSO TO CITATION(S) 20925, 20926*

**21058 Effect of concentrations of water/fuel oil emulsions on the total emission of solid particles from oil fired boilers.** Holling, H.P. (Esso A.G., Hamburg (Germany, F.R.)). *VGB Kraftwerkstech.;* **57**: No. 6, 400-403(Jun 1977). (In German).

Statutory regulations for the protection of the environment are concerned with mass concentrations of dust emitted from combustion chambers. A reduction can be attained by improving the combustion of atomized fuel oil in oil-fired boilers. By adding water better atomization and thus improved combustion can be achieved. The results of tests are reported.

**21059 Effect of oxygen concentration on the rate of liquid phase oxidation of jet fuels.** Gureev, A.A.; Chertkova, N.Ya. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 47-49(1977). (In Russian).

The effect of oxygen concentration in the oxidizing gas on the rate of liquid-phase oxidation of jet fuels of different degree of purification, within the temperature range of 130-150C, is studied. It is found that fuel oxidation rate depends essentially on oxygen concentration in the oxidizing gas. When oxygen is replaced by air, oxidizing conditions change from the kinetic regime to the diffusion regime. As the degree of purification of fuel rises, its sensitivity to the concentration of oxygen in the oxidizing gas at the same oxidation temperature increases.

# NATURAL GAS

*REFER ALSO TO CITATION(S) 20840, 21469*

**21060** (CONF-770375—) **Proceedings of the fifty-sixth annual convention of the Gas Processors Association.** (Gas Processors Association, Tulsa, Okla. (USA)). 1977. 185p. Processors Association, Tulsa, OK.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

Papers were presented at the convention on natural gas research programs, divestiture, cryogenic plants, and natural gas liquids. A separate abstract was prepared for each of eight papers. (JRD)

## RESERVES

**21061** (HI—2451/3-P) **100,000 quads of natural gas.** Brown, W.M. (Hudson Inst., Inc., Croton-on-Hudson, N.Y. (USA)). Oct 1976. 38p. Institute, Inc., Croton-on-Hudson, NY $7.00.

Of the various possible unconventional natural gas resources that have been examined, the most recent, and by far the largest, is that which is dissolved in the hot salt water within the geopressurized zones of the Gulf Coast. Recent assessments have estimated that the amount of gas contained in these waters, underlying about 150,000 sq. mi. of Texas and Louisiana—both onshore and offshore—is between 60,000 and 100,000 quads. In addition to the natural gas, there is a huge potential for producing electric power from the heat content of the fluid, as well as other potential uses for hot water. The net value of this geothermal heat may be about half that of the natural gas. The major problems associated with commercial production of the fluids from these zones and the extraction of energy from the heat and pressure of the fluid are discussed and the long-term potential is estimated. It appears likely that commercial production will depend upon the existence of uncontrolled prices for natural gas and the satisfactory resolution of various legal, environmental, and institutional problems, all of which are likely to require considerable effort. Although the production potential from the Gulf Coast zones might be accurately estimated after a decade or so of active research and development, at present the long-term potential appears to be between 4 percent and 50 percent of the fluid within the reservoirs that are eventually developed. Although the costs of production of gas and electric power from this resource may not be cheap, the principal reservoirs should be relatively easy to locate in the onshore Gulf region because of the existing data available from the vast number of wells that have already been drilled.

## GEOLOGY AND EXPLORATION

*REFER ALSO TO CITATION(S) 20937, 20938, 20939, 20941, 20942, 20945, 20947, 20961, 21102*

**21062** **Results and effectiveness of gas prospecting operations in the main areas of the western Precaucasus.** Naurol'nyy, I.K. *Geol. Nefti Gaza;* No. 4, 15-20(Apr 1977). (In Russian).

The effectiveness of search and prospecting drilling during the Ninth Five Year Plan in the Western Precaucasus was significantly higher than in the Eighth Five Year Plan. The main prospects for finding gas in the Western Precaucasus are related to the Jurassic deposits of the Eastern Kuban' depression and the Adygeyskiy Ridge, at depths of 6 to 8 km. As concerns general geological characteristics, the Mesozoic deposits are promising for gas in other regions of the Western Precaucasus, such as the Western Kuban' downwarp and Taman'. However, these areas have almost never been studied by drilling due to the great depths involved.

**21063** **Caroline carbon dioxide field and associated carbon dioxide occurrences, gambier embayment, south australia.** Mulready, J. (Alliance Oil Manage Ltd, Melbourne, Aust). *APEA J.;* **17**: 121-127(1977).

Subsurface occurrences of high purity carbon dioxide are comparatively rare although widespread geographically. Within the Gambier embayment of the Otway Basin two substantial examples of carbon dioxide entrapment have been encountered, at Kalangadoo No. 1 with 147 tonnes/day (2.8 mmcf/day) and Caroline No. 1 with 142 tonnes/day (2.7 mmcf/day). Australia's only commercial production of subsurface $CO_2$ is the Alliance Caroline well which produces at an annual rate of around 15,000 tonnes (0.3 BCF) per annum of liquid CO$sub 2$. Treatment is limited to removal of the 1% hydrocarbon content of the well-head stream by simple fractionation. 16 refs.

## DRILLING, PRODUCTION, AND PROCESSING

*REFER ALSO TO CITATION(S) 20948, 20952, 20960, 20961, 20969, 20982, 20983, 21004, 21086, 21735*

**21064** (CONF-770375—, pp 1-10) **Evaluation of thermophysical property correlations.** Chappelear, P.S.; Chen, R.J.J.; Elliot, D.G. (McDermott Hudson Engineering, Houston, TX). 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

The trend during the last decade to higher ethane recoveries has precipitated an increase in the use of the cryogenic (turboexpander) process for gas processing facilities. The design of such plants requires vapor-liquid equilibrium and thermodynamic properties information which is typically not available. Historically, the availability of such data has lagged behind design and construction of gas processing plants. Today there are available several correlations based on experimental data. The GPA research program has played a decisive part in the efforts both to obtain reliable experimental data and to develop useful correlations. Many of the correlations are marketed by GPA. These data have been reported in GPA research reports, technical publications, and proceedings of the annual meetings. The importance of accurate K-value correlations in cryogenic plant design was demonstrated by comparing predicted product recoveries for a typical cryogenic plant using several correlations available at that time. The various K-value correlations gave predicted recoveries for ethane from 25.7 to 45.0% and for propane, from 66.7 to 90.7%. Since that time much progress has occurred in correlations. Existing correlations have been refined and new correlations have been introduced. The importance of accurate thermophysical properties on plant design is discussed and the properties predicted by generally available correlations are compared.

**21065** (CONF-770375—, pp 88-91) **Importance of feed gas conditioning.** Neumann, W.M. Jr. (Cities Service Co., Tulsa, OK). 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

Discussions are presented of possible startup problems in cryogenic gas processing plants due to commonly occurring contaminants in the feed gas.

**21066** (CONF-770375—, pp 123-125) **Evolution in design.** McKee, R.L. (McDermott Hudson Engineering, Houston, TX). 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

The rapid evolution in cryogenic plant design over the last twelve years encompasses improvement in accuracy of design, choice of materials, flexibility of operation, and thermodynamic efficiency which create profit opportunities in new and modified plants.

**21067** (CONF-7603113—) **Proceedings of the gas conditioning conference.** (Oklahoma Univ., Norman (USA)). 1976. 253p. of Oklahoma, Norman $10.00.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

Papers were presented at the conference on sour gas processing corrosion control, coal gasification, natural gas dehydration and desulfurization, gas quality control, and gas handling equipment. A separate abstract was prepared for each of thirteen papers. (JRD)

**21068** (CONF-7603113—, pp B1-B19) **Corrosion control in gas processing plants which remove both $CO_2$ and $H_2S$.** Asperger, R.G. (Dow Chemical Co., Midland, MI); Davidson, J.R.; Martin, C.W.; Pearce, R.L. 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Methods of evaluating corrosion in amine units using electronic equipment are reviewed. Until now, the use of high monoethanolamine concentrations for $H_2S$ and $CO_2$ mixed gas service has been limited by corrosion problems. It has been shown in the laboratory, pilot plant and field plants, that high amine concentrations can be used if good corrosion control is utilized. Considerable energy savings can be achieved by operating units at 30% MEA instead of 15-20%. If the gas being removed is mostly $H_2S$, it is theoretically possible to run existing or grass-roots plants at even higher amine concentrations which is limited primarily by the heat of reaction liberated in the absorber. Corrosion at high amine concentrations should no longer be the limiting factor in saving energy or expanding capacity for existing MEA units.

**21069** (CONF-7603113—, pp D1-D20) **Molecular sieve dehydration and treating in expander plants: update.** Corvini, G. (Union Carbide Corp., Tulsa, OK). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Drying natural gas feed to exander plants using molecular sieves is examined. Information is included on uses and properties of molecular sieves, plant design, and engineering service. A molecular sieve unit should be considered as a totally engineered system. Effort

must be spent selecting the best product for the application and choosing the optimum design trade-offs between economy and operating flexibility. Final optimization can only be done on the basis of detailed field engineering. When this is done, a total engineering loop concept is closed. This approach provides the industry with reliable up-to-date units of proven performance and a broad design flexibility which allows for economic optimization of the total system. (JRD)

**21070** (CONF-7603113—, pp E1-E9) **Gas quality monitoring.** Hatfield, J.R. (Northern Natural Gas Co., Omaha). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Development of an $H_2O$-$H_2S$ analyzer is discussed. It is felt that the electron capture/gas chromatography (E.C./G.C.) system offers many advantages in the monitoring of $H_2O$ and $H_2S$ that the flame photometric G.C. offers for sulfur compounds in general. The F.P./G.C. is specific for sulfur and allows the identification and quantitative analysis of individual compounds. The E.C./G.C. although not specific to $H_2O$ and $H_2S$ is highly selective to them over the hydrocarbons making up the bulk of a natural gas sample. E.C. response relative to methane is in the order of 100 for water and 10,000 for $H_2S$. It also has the advantage inherent in gas chromatography of separating and analyzing individual compounds. Although the microprocessor operated E.C./G.C. would be more expensive than conventional $H_2S$ or $H_2O$ monitors, the capability of combining functions and multiplexing offers significant economic advantages. In addition, it should be capable of producing reliable $H_2O$ and $H_2S$ analysis where conventional instrumentation would fail.

**21071** (CONF-7603113—, pp F1-F30) **Fundamentals of gas treating.** Jones, V.W.; Perry, C.R. (Perry Gas Processors, Inc., Odessa, TX). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Gas sweetening processes using monoethanol amine or diethanol amine are discussed. Descriptions of the processes are given along with process design calculations and process flowsheets. (JRD)

**21072** (CONF-7603113—, pp G1-G10) **Glycol dehydration of natural gas containing $H_2S$ and $CO_2$.** Kemp, A.H. (Black, Sivals, and Bryson, Inc., Houston, TX). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Aspects of glycol dehydration of acid gas streams are discussed. Process flow for glycol type dehydration is described along with sour-gas operations, removal of gases from glycol, equipment corrosion, and environmental effects. (JRD)

**21073** (CONF-7603113—, pp H1-H23) **Sweetening of light hydrocarbon liquids.** Maddox, R.N. (Oklahoma State Univ., Stillwater). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Processes for removal of $H_2S$ and other organic sulfur compounds from natural gas are discussed. Information is included on $H_2S$ removal methods, and mercaptan removal methods. Flowsheets are included for amine treating processes, molecular sieve processes, caustic wash processes, iron oxide processes, copper sweetening processes, and catalytic processes. (JRD)

**21074** (CONF-7603113—, pp I1-I9) **Iron sponge treating of natural gas liquids.** Moore, F.M. (Sun Oil Co., Oklahoma City). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Treatment of liquid hydrocarbon streams using iron sponge is discussed. The iron sponge treatment is necessarily a wet process and a downstream drier is required should specifications call for drier than "no free water." The iron sponge does not remove carbon dioxide. Education of personnel is necessary due to the flammability of the iron sulfide. Regeneration should be carried out at a moderate rate to prevent overheating and a possible explosion; and any spent beds should be kept wet during removal and disposed of immediately and safely. Bed removal is made easier by steaming just prior to removal. The iron sponge has provided adequate treatment of the liquid product and should provide an economical, simple and effective treatment for liquid streams of low to moderate sulfide contamination. (JRD)

**21075** (CONF-7603113—, pp K1-K24) **Selective hydrogen sulfide removal.** Pearce, D.L. (Dow Chemical U.S.A., Freeport, TX); Brownlie, T.J. 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

There are a number of processes that can selectively remove $H_2S$ from gases containing both $H_2S$ and $CO_2$. Several techniques can be employed to enhance selectivity with a given absorbent. The process design for selective $H_2S$ removal cannot be made from knowledge limited to one or two variables. The full range of inlet gas conditions, final treatment requirements, sulfur disposal, and energy limitations enter into optimum plant design. The methyldiethanolamine (MDEA) process has been studied by Dow among others, and although it does not contain all the desirable characteristics of an ideal selective $H_2S$ solvent, it does have a good overall balance of worthwhile properties. The low utilities coupled with favorable selectivity and capacity makes the process worthy of serious evaluation when searching for a versatile acid gas removal process.

**21076** (CONF-7603113—, pp L1-L2) **Operating experience with amine absorber level control valves.** Scheirman, W.L. (J. F. Pritchard and Co., Kansas City, MO). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

In late 1974, a survey was made of amine absorber level control valve experience at several gas plants. A summary of the information is shown in a table. From the few case histories obtained, it appears that carbon steel globe body valves with body size sufficient to use reduced trim of 316 stainless steel Stellited or 17-4 pH material are giving generally acceptable service. One large plant has experienced considerable problems with angle body valves. Operating information was obtained on only one other location using an angle valve. After 12 years of service, that valve body has eroded. Most suppliers recommend carbon steel valve bodies. One operating company prefers to use 316 stainless steel body material with 316 stainless steel Stellited trim, 316 stainless steel cage, and K-monel stem guide bushings. Carbon steel bodies are usually used in hot carbonate gas treating plants.

**21077** (CONF-7603113—, pp O1-O39) **Glycol dehydrator design manual.** Sivalls, C.R. (Sivalls Tanks, Inc., Odessa, TX). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

An absorption process using triethylene glycol for dehydration of natural gas is described. The main design items required for a triethylene glycol dehydration unit such as the glycol-gas contactor, glycol circulation pump, reboiler, and stripping may be designed using procedures and formulas that are described in the paper. Standard dehydrator units based on manufacturer's catalog data can then be selected based on the minimum design criteria as determined. Also, the procedures may be used in evaluating the performance or determining the maximum gas capacity of any given specific size glycol dehydration unit. (JRD)

**21078** **Process and equipment employed in the vaporisation and conditioning units of the Nievenheim LPG plant.** Jung, W. (Thyssengas G.m.b.H., Duisburg (Germany, F.R.)). *Gas- Wasserfach, Gas-Erdgas;* **118**: No. 8, 334-341(Aug 1977). (In German).

The concept of the process and machine technique of the vaporization and conditioning unit for liquid natural gas in the liquid natural gas plant Nievenheim in shown, with an explanation of the choice of the conditioning medium 'air'. The engineering fundamentals of the conditioning with air are presented. The connection between liquefaction and extraction regarding the aimed quality of the liquid natural gas is indicated. A few characteristic liquid natural gas analyses are given as examples. The use of the same compressor for liquefaction and compression of the air required for conditioning is shown. The regulation of the mixture of vaporized liquid natural gas and air is explained. Top gas analyses obtained are compared with pre-calculated values.

**21079** **Process and machine technology used in vaporization and conditioning units of Nievenheim Liquefied Natural Gas Plant.** Jung, W. (Thyssengas, Duisburg, Ger). *Gas- Wasserfach, Gas-Erdgas;* **118**: No. 8, 334-341(Aug 1977). (In German).

Selection of conditioning media is discussed and process technological aspects of using air arc analyzed together with calorific value calculations. Technical characteristics of compressors are given. 7 refs.

**21080** **Intensification of the operation of vertical gravity-type separators.** Shalaikin, A.F.; Zavertailo, M.M.; Akhmedov, A.A. (Krasnodar Sci Res Pet Inst, USSR). *Neft. Khoz.;* No. 7, 31-33(Jul 1977). (In Russian).

Field tests of a natural gas preparation plant employing multilayer overflow-inhibiting plates showed the superiority of those plates over a vertical volume separator. This applies, in particular, to the possibility of carrying out gas separation at higher outputs. Moreover, field treatment of gas in a plate-type separator occurs

more efficiently and makes it possible to carry out both drying and purification of the gas in a single plant. 4 refs.

**21081 Principle of operation and method of calculating depulsators.** Repin, N.N.; Kryukov, V.A. (All-Union Sci Res Pet Inst, USSR). *Neft. Khoz.;* No. 7, 34-36(Jul 1977). (In Russian).

The main trends in increasing the efficiency of operation of depulsators are reviewed. Recommendations are made regarding the choice of the diameters, the length of the final vibration-damping sections, and the design of the depulsator, and also regarding the positioning of the depulsator relative to the separation plants. 3 refs.

**21082 Use of pulsation-type cooling plants for low-temperature treatment of natural gas.** Surkov, Yu.V.; Sirotin, A.M.; Laukhin, Yu.A.; Petera, I.P.; Bobrov, D.M.; Fishman, L.L. (All-Union Sci Gas Inst, USSR). *Neft. Khoz.;* No. 7, 39-41(Jul 1977). (In Russian).

A pulsation-type gas cooling plant is proposed the principle of operation of which is based on the use of shock-wave processes occurring during periodic compression of the gas by a high-velocity gasjet in closed receiver pipes. This leads to heating of the receiver gas and heat transfer to the pipe walls. The heat is removed from the walls by free convection or by forced cooling.

**21083 Investigation of the quality of gas well cementing by detailed thermometry methods.** Pozin, L.Z.; Dyachenko, A.G.; Kremenetskii, M.I. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 3-9(1977). (In Russian).

A method of joint processing of the thermogram of determination of the cement ring lift height and of the cavernogram for the purpose of studying the quality of cementing of the well space outside the pipe string, is considered. Examples of the application of the method in the Moscow region are given.

**21084 Design of automatic condensate extractors.** Ushakov, V.I. (Kurskii Polytech Inst, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 56-58(1977). (In Russian).

The diagram of an automatic condensate extractor is considered. Its purpose is to remove condensation products from gas installation apparatus and gas mains condensate collectors. Formulas are proposed for the calculation of its principal characteristics. Data are presented on the operation of condensate extractors calculated according to these formulas and manufactured.

**21085 New development of the Tealarc natural gas liquefaction process.** Dufresne, J.; Gauberthier, J.; Schlatter, R. (Technip, Fr). *APEA J.;* **17**: 128-130(1977).

Through its operating experience of base-load plants and the research and development studies performed, France's Technip has improved the Tealarc liquefaction process with regard to the main criteria: efficiency, reliability, flexibility, simplicity and has also adopted the Tealarc process to the use of centrifugal compressors. In this case the Tealarc process is split into two different cycles, the first Tealarc cycle called "Precooling cycle" is used to partially condense the cryogenic fluid of the second Tealarc cycle called "Liquefaction cycle" which performs the condensation of the natural gas and the subcooling of LNG. This arrangement of the precooled Tealarc process allows the realization of large capacity liquefaction trains while satisfying the limitation of the centrifugal compressor. 2 refs.

## PRODUCTS AND BY-PRODUCTS

*REFER ALSO TO CITATION(S) 21079, 21085, 21090*

**21086 Desulfurization of wide cut of light hydrocarbons from Orenburg gas condensate.** Mazagarov, A.M.; Neyaglov, A.V.; Talyakov, E.Sh.; Akhmadullina, A.G.; Matyushko, B.N.; Fomin, V.A. (All-Union Sci-Res Inst of Hydrocarbon Raw Mater, USSR). *Chem. Technol. Fuels Oils (USSR) (Engl. Transl.);* **12**: No. 11/12, 902-905(1976).

The opening of the Orenburg gas condensate field has posed a number of problems, mainly in the treatment of the gas, the wide cut of light hydrocarbons (WCLH), and the stabilized condensate to remove mercaptan, sulfide, and disulfide sulfur. The depropanized wide cut will be mixed with the stabilized condensate and this mixture desulfurized in a hydrotreating unit. The distribution of sulfur compounds in the hydrocarbon fractions of the Orenburg gas condensate has been investigated by means of a laboratory unit. It was found that the disulfides and thiophenes are concentrated in the hexanes and heavier fractions, but the sulfides are distributed in the fractions beginning with n-butane. In this connection, a feasibility study has been made on the production of a WCLH with minimum content of $C_5$-$C_6$ hydrocarbons by making changes in the operating conditions of the unit producing this material. According to the design, the WCLH is produced in the Orenburg gas processing plant in Unit 90 by recovery from the stabilization gases (treated to remove hydrogen sulfide) and the stabilized condensate (distillation range -35° to +230°C). The stabilization process was calculated in an M-222 computer. The content of mercaptan sulfur in the wide cut after treating is less than 0.001% by weight, and the hydrocarbons in the exhaust air amount to no more than 0.1% by volume. 5 refs.

## HEALTH AND SAFETY

*REFER ALSO TO CITATION(S) 21067*

**21087** (CONF-7603113—, pp A1-A13) **Philosophies of safety in sour gas processing.** Archibald, R.G. (Shell Canada Ltd., Calgary, Alberta). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

Problems associated with handling $H_2S$ are discussed. Information is included on properties of $H_2S$, treatment of $H_2S$ cases, $H_2S$ detection, $H_2S$ personal protection equipment, types of breathing and resusitation equipment, emergency procedures, plant design, and plant control. (JRD)

**21088** (CONF-7603113—, pp P1-P11) **Relationship of new Texas sour gas rules to gas conditioning operations.** Smith, J.E. (Railroad Commission of Texas, Austin). 1976.

From Gas conditioning conference; Norman, OK, USA (8 Mar 1976).

In Proceedings of the gas conditioning conference.

he Texas Railroad Commission regulation concerning gas conditioning operations is reviewed. Problems associated with hydrogen sulfide are discussed. No one can take issue with the fact that a hydrogen sulfide problem does exist, but it is important to keep the degree of danger in perspective. It should be recognized that it is necessary to have four complementing coincidences occurring to have a hydrogen sulfide problem including undetected leaks, toxic concentrations, non-dispersion causing weather conditions, and an exposure victim. The probability of all these occurring at the same time is very remote, but it has happened, and it cannot be assumed that the laws of probability can be depended upon to prevent hydrogen sulfide effects. (JRD)

## MARKETING AND ECONOMICS

*REFER ALSO TO CITATION(S) 21004, 21737*

**21089 Tendencies of technical and economic development in the public gas supply industry.** Duewel, G. (Hamburger Gaswerke G.m.b.H. (Germany, F.R.)). *Gas- Wasserfach, Gas-Erdgas;* **118**: No. 8, 347-350(Aug 1977). (In German).

A survey is given on the present competitive state of natural gas in the Federal Republic compared with other energy carriers. The safety of the gas supply is guaranted by the extensive supply from European countries as well as by an extensive diversification of the supply sources. The problems of the adaptation of equipment to the various natural gases are indcated. The demand for a high number of hours of use necessitates the availabity of large storage possibilities. Besides the levelling-out of the supply, a series of further problems in the field of gas distribution and utilization await.

**21090 Technical and economic development trends in the gas supply industry.** Duewel, G. (Hamburg Gaswerke, Ger). *Gas- Wasserfach, Gas-Erdgas;* **118**: No. 8, 347-350(Aug 1977). (In German).

Energy and gas resources are analyzed, and reliability of supply sources is investigated. Liquefaction and storage of natural gas from imports are discussed.

## WASTE MANAGEMENT

*REFER ALSO TO CITATION(S) 21006*

## POLICY, LEGISLATION, AND REGULATION

*REFER ALSO TO CITATION(S) 21813, 21814*

## TRANSPORT, PIPELINES, AND HANDLING

*REFER ALSO TO CITATION(S) 21737*

**21091** (CONF-770375—, pp 45-49) **Heating value and specific gravity measurement of natural gas for custody transfer using a computer operated process chromatography system.** Leisey, F. (Amoco Texas Refining Co., Texas City); Potter, G.; McCoy, R. 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

Faced with a decision to replace and upgrade instrumentation to measure the heating value and specific gravity of natural gas for custody transfer, Amoco Gas Company purchased and installed a process gas chromatograph operated by a digital computer to automatically make these measurements. As compared with conventional measurement techniques, the new chromatograph system is less expensive, requires less maintenance, meets safety requirements, provides data in the form needed for invoicing, and requires less space.

**21092** **Situation on the LNG tanker market.** Faust, P. (Inst fuer Seeverkehrswirtsch, Bremen, Ger). *Erdoel-Erdgas Z.;* **93**: No. 8, 265-268(Aug 1977). (In German).

The preent as well as future demand for LNG tankers basically depends on the needs for natural gas, which will increasingly have to be met by LNG imports, and also on the distance between the points of production and consumption. The author does not consider short and medium-term prospects for the LNG tanker market as good but sees an upsurge in LNG shipments by tanker in the long run that will be further strengthened by larger shipping distances. The current long-term contracts for overseas LNG shipments are surveyed, and a breakdown of the existing and contracted LNG tanker fleet by single building countries is given for 1976 and 1977.

**21093** **Distribution research.** Needham, D. (Eng Res Stn, Br Gas Corp). *Gas Eng. Manage.;* **17**: No. 8, 278-291(Aug 1977).

The author reviews British Gas Corp.'s RandD work at the Engineering Research Station with respect to distribution. It is shown how RandD works with the operating sector, and various developments in pipe materials, components and coatings, as well as in gas control and equipment are surveyed. It is recognized that, in the final analysis, RandD is useless unless its results are applied and found to be successful in the field.

**21094** **LNG transport costs cut by concrete.** *Pet. Rev.;* **31**: No. 367, 15-16(Jul 1977).

The use of concrete instead of conventional steel ships to carry liquid natural gas could cut transportation costs by a considerable margin according to the new concept outlined here. The reinforced concrete hull self-propelled carrier will have insulated cargo tanks integrated within the hull. Unlike a conventional LNG carrier with its double hull, the vessel is of a single hull design.

**21095** **Statistical method of locating gas leaks along a gas pipeline route.** Ionin, D.A.; Yakovlev, E.I.; Dobryak, D.S. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 83-87(1977). (In Russian).

The method of detecting gas leaks and determining their location, considered in the article, is based on the evaluation of the difference between the times of arrival of pressure disturbances due to a rupture of the gas pipeline, at the ends of a controlled sector. Algorithms of determination of the location of a leak and of a maximum-probability estimation of its magnitude are proposed. The potential accuracy of the proposed method is evaluated. Calculations that have been made show that this method is highly accurate.

**21096** **Investigations of displacements of open sections of pipelines.** Gagen, Yu.G.; Gaidash, N.L. (Ivano-Frankovskii Inst of Pet and Gas, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 81-84(1977). (In Russian).

Results of on-the-spot inspections of the "Brotherhood-2" natural gas pipeline (from the USSR to Czechoslovakia across the Carpathians) are presented. A formula is derived to determine lateral shifts of open pipeline sections, taking into consideration the effect of the angle of rotation in the plan, the angle of inclination of the compensator to the horizontal plane, and the ratio between the departure of the compensator and the length of the compensated sector.

## PROPERTIES

*REFER ALSO TO CITATION(S) 21039, 21040, 21046*

**21097** **Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring.** Weitz, P.G. Jr. (Simmonds Precision Products, Inc., Vergennes, Vt. (USA)). *Gas- Wasserfach, Gas-Erdgas;* **118**: No. 8, 331-333(Aug 1977). (In German).

A survey is given on the present method of determining the calorific value of liquefied hydrocarbon gases. Their possible faults are also discussed. These measuring principles are compared with a new method in which one obtains very accurate calorific values by determining the dielectric constants of the liquid phase.

**21098** **Calorific value determination of liquefied hydrocarbon gases by capacity measuring.** Weitz, P.G. (Simmonds Precis Prod, Vergennes, Vt). *Gas- Wasserfach, Gas-Erdgas;* **118**: No. 8, 331-333(Aug 1977). (In German).

Present measuring methods are compared with the capacity measurement method in both liquid natural gas and liquid gas. Effect of nitrogen on LNG mixtures is analyzed and apparatus to measure the dielectric constant is described. 8 refs.

## STORAGE

*REFER ALSO TO CITATION(S) 21055, 21056*

**21099** **Hydrodynamic investigation of gas volume dynamics in a stratum of constant thickness.** Kochina, I.N.; Filinov, M.V. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 3, 63-69(1977). (In Russian).

A problem of forcing gas at a variable rate into an aquifer of constant thickness is considered. The gas pressure and the volume occupied by it are determined. The problem is solved by the method of singular perturbations. The approximate solution obtained is compared with the available exact solution and a satisfactory agreement between them is revealed. First of all, in order to explain the method, the known self-similar problem of forcing gas at a constant rate into an aquifer is considered.

# OIL SHALES AND TAR SANDS

*REFER ALSO TO CITATION(S) 20840*

## RESERVES AND EXPLORATION

*REFER ALSO TO CITATION(S) 20841*

**21100** **Evaluation of digitally enhanced LANDSAT data as applied to mineral and hydrocarbon exploration.** Smith, A.F.; Baker, R.N. (General Electric Co., Beltsville, MD). pp 872 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Digital enhancement of satellite data from NASA's Land Satellite (LANDSAT) is providing new information useful to a variety of natural resources investigations, including mineral and hydrocarbon exploration. Experience has revealed that digital processing of the satellite's computer compatible tapes is the only feasible and efficient method for extracting the maximum amount of valuable geological information contained in them. This study provided an opportunity to critically evaluate the application of enhanced data in extracting additional geological information from test sites in central Colorado and northwestern Canada, which are areas of significant metallic mineralization and hydrocarbon potential, respectively. Digital enhancement techniques applied to these test sites included multispectral band ratioing, edge enhancement, clustering, normalization, contrast stretching, and multidimensional signature analysis, using General Electric's IMAGE 100 multispectral information computer processing system. Lineament distribution and density were used to define sites of potential mineralization in central Colorado (Knepper, 1974). Special enhancements of the digitally processed data using the IMAGE 100 resulted in the delineation of additional structural and lithologic information, thus enabling us to further define the mineral exploration maps produced by Knepper. Enhanced imagery from a test site in northern Alberta, Canada, was found to contain evidence useful for determining the distribution and areal extent of the Athabasca tar sands. Preliminary results of these analyses reveal that digital enhancements of satellite data can be of significant value to geologists in their mineral and hydrocarbon exploration efforts.

## SITE GEOLOGY AND HYDROLOGY

### SITE GEOLOGY

**21101** (MERC/SP—77/7) **Some practical considerations in x-radiography.** Renton, J.J. (West Virginia Geological Survey, Morgantown (USA)). Dec 1977. Contract EY-76-C-05-5199. 37p. Dep. NTIS, PC A03/MF A01.

An X-radiograph is a photographic image of the preferential transmission (or absorption) of X-radiation by a solid object. The technique can supply an enormous amount of information with a minimal investment of time and money. However, obtaining high-quality, high-resolution radiographs requires a basic understanding of the process of radiography, and an optimization of a series of experimental parameters. This paper discusses the basic technique, discusses the experimental parameters and their relative effects, demonstrates the capabilities of X-radiography as an analytical technique, and includes an appendix of radiographs of Devonian shale material.

**21102** (MERC/TPR—77/3) **Organic composition of Devonian Shale from Perry County, Kentucky.** Lamey, S.C.; Childers, E.E. (Department of Energy, Morgantown, W.Va. (USA). Morgantown Energy Research Center). Dec 1977. 28p. Dep. NTIS, PC A03/MF A01.

Shale samples selected at 5-ft intervals from a 339 foot section of core in the depth interval from 2369.0 feet to 2708.0 feet of the Devonian Shale from Perry County, Kentucky were studied to determine the quantity of organic matter present, fuel potential, distribution of organic compounds, and the composition of the benzene soluble and insoluble fractions. The methods used consisted of infrared spectroscopy, thermal chromatography, extraction techniques, Fischer Assay, and elemental analysis. Resultant depth profiles of total organics, organic to mineral carbon, pyrolytic oil yield, oil carbon number distribution, benzene soluble organic fraction, and major elemental composition of the benzene soluble organics are presented. The organic material is contained in several well-defined zones throughout the length of the core, but individual samples in one zone also show variations in the amount of organic material present. The pyrolytic conversion of the organic content to oil is relatively constant. There is little variation in the chain length of the organic components as a function of depth. 5 tables, 6 figures.

## DRILLING, FRACTURING, AND MINING

*REFER ALSO TO CITATION(S) 21108*

## OIL PRODUCTION, RECOVERY, AND REFINING

*REFER ALSO TO CITATION(S) 20912*

### IN SITU METHODS, TRUE AND MODIFIED

**21103** (MTI—78TR16) **Evaluation of pump used for in situ oil recovery from tar sands.** McCabe, J.T.; McGee, J.P. (Mechanical Technology, Inc., Latham, N.Y. (USA)). 10 Nov 1977. Contract EF-77-C-01-2615. 13p. Dep. NTIS, PC A02/MF A01.

A field experiment is being conducted near Vernal, Utah for oil recovery from tar sands by in-situ combustion. The principal mechanical problem was identified as repeated failure of the pumps used to lift the oil from the production wells. The primary problem plaguing the sucker-rod pumps is that the pump barrel frequently plugs with sand, and the pump must be pulled from the bottom of the hole to be cleared. Other problems were also encountered due to combustion of the elastor seal and pump, plugging from solidified bitumen, and wear. It is recommended that the gas lift method should be used to pump oil at this site, and for future sites hot-water and condensing-steam pumps should be compared with the sucker rod pump. (DLC)

**21104** (TID—27970) **BX in situ oil shale project. Quarterly progress report No. 1, March 1—May 31, 1977.** (Equity Oil Co., Salt Lake City, Utah (USA)). 10 Jun 1977. Contract EF-77-A-04-3880. 10p. Dep. NTIS, PC A02/MF A01.

Activities in an in situ oil shale retorting demonstration are reported. The demonstration project is located in Rio Blanco County, Colorado. Owing to the delay in execution of the agreement, the project is modestly behind schedule, but it is felt that it will be possible to complete all the field work related to the Leached Zone Site Evaluation prior to mid July 1977, and consequently it should be possible to be on schedule with the balance of the project. The work accomplished at the project site to date relates totally to the Leached Zone Site Evaluation, and a separate report covering that matter will be submitted upon completion of the Vertical Communication Test. (JRD)

### SURFACE METHODS

*REFER ALSO TO CITATION(S) 21108*

**21105** (UCRL—52256(Pt.2)) **Oil shale retorting: Part 2, variation in product oil chemistry during retorting of an oil shale block.** Coburn, T.T.; Campbell, J.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Sep 1977. Contract W-7405-ENG-48. 34p. Dep. NTIS, PC A03/MF A01.

This report discusses the variation in composition of oil as it is evolved during the pyrolysis of oil shale. Thirteen shale oil fractions collected during pyrolysis of an 18- x 18-cm cylindrical shale block have been analyzed by measurements of density, viscosity, elemental composition, simulated distillation, GLC, $^{1}H$ and $^{13}C$ NMR, and infrared spectroscopy. The results show a striking change in the composition of oil collected early during retorting, as compared with that collected during the middle or latter part of retorting. In particular, the early oil fractions contain a predominance of naturally occurring isoprenoid compounds, whereas later fractions contain larger amounts of paraffin compounds. Less dramatic changes include variations in the amounts of olefins, aromatics, and degree of aromatic substitution, changes in amount of nitrogen-containing compounds, and variations in density and viscosity. The results of these analyses are used to form a picture of the changes in shale oil composition during retorting in the hope that a clearer understanding of the system's chemistry may eventually provide a way to optimize the shale oil retorting process.

## PROPERTIES AND COMPOSITION

*REFER ALSO TO CITATION(S) 20874, 21105*

**21106** **Pyrolysis of Carpathian menilitic shales and production of cellular materials from them.** Grinberg, I.V.; Pan'kova, T.V. (Inst of the Geol and Geochem of Combust Miner of the Acad of Sci of the Ukr SSR). *Solid Fuel Chem. (USSR) (Engl. Transl.);* **10**: No. 5, 12-23(1976).

The paper considers some of the main results of investigations over many years in the field of the knowledge of the chemical nature of the organic and mineral substances of Carpathian menilitic shales. The results of investigations of the composition and technical properties and structure of the components of the kerogen-mineral matter are given. The conditions for its pyrolysis and the products obtained have been studied; the mechanism of the formation of cellular materials from the shale and its semicoke is discussed. Some of the main theoretical and experimental questions of the comprehensive processing of the raw materials of the shale and chemical industry in the western regions of the Ukrainian SSR are developed. Extensive test data are tabulated and evaluated. 6 refs.

**21107** **Thermal decomposition of kuckersite shale in vacuum.** Urov, K.E. (Inst of Chem, Acad of Sci of the USSR, Est SSR). *Solid Fuel Chem. (USSR) (Engl. Transl.);* **10**: No. 5, 24-29(1976).

The composition of the shale tar formed in the individual stages of the thermal decomposition of kuckersite in vacuum has been investigated. Information is given on the sequence of the formation of the components of the tar in the thermal decomposition of the kerogen. 15 refs.

## WASTE RESEARCH AND MANAGEMENT

**21108** (UCID—17682) **Continuous water monitor for oil-shale retort effluent.** Morrison, R.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Nov 1977. Contract W-7405-ENG-48. 13p. Dep. NTIS, PC A02/MF A01.

The design and construction of a hygrometer for measurement of water in oil shale retort effluent gas are reported. The theory of operation is presented along with discussions of instrument design and operating instructions. (JRD)

## ENVIROMENTAL ASPECTS

*REFER ALSO TO CITATION(S) 20912*

# NUCLEAR FUELS

## RESERVES

**21109 (LA—7062-MS) Uranium mill monitoring for natural fission reactors.** Apt, K.E. (Los Alamos Scientific Lab., N.Mex. (USA)). Dec 1977. Contract W-7405-ENG-36. 31p. Dep. NTIS, PC A03/MF A01.

Isotopic monitoring of the product stream from operating uranium mills is proposed for discovering other possible natural fission reactors; aspects of their occurrence and discovery are considered. Uranium mill operating characteristics are formulated in terms of the total uranium capacity, the uranium throughput, and the dilution half-time of the mill. The requirements for detection of milled reactor-zone uranium are expressed in terms of the dilution half-time and the sampling frequency. Detection of different amounts of reactor ore with varying degrees of $^{235}U$ depletion is considered.

**21110 (MP—65) Blind River uranium deposits: the ores and their setting.** Robertson, J.A. (Ontario Ministry of Natural Resources, Toronto (Canada)). 1976. 45p. Dep. NTIS (US Sales Only), PC A03/MF A01.

From The genesis of uranium- and gold-bearing precambrian quartz-pebble conglomerates; Golden, Colorado (13 Oct 1975).

The Matinenda Formation (basal Huronian) comprises northward-derived arkose, quartzite, and pyritic, uraniferous oligomictic conglomerate that contains 75 percent of Canada's uranium reserves. The conglomerate beds occur in southeasterly striking zones controlled by basement topography down-sedimentation from radioactive Archean granite. The mineralization is syngenetic, probably placer. Drab-coloured rocks, uranium and sulphide mineralization, and a post-Archean regolith formed under reducing conditions, suggest a reducing environment. Sedimentary features indicate deposition in fast-flowing shallow water, and possibly a cold climate.

**21111 Recent development of the process and mineral industries in Australia.** Magasanik, D. (Economic Research Pty Ltd., Melbourne (Australia)); Robinson, I.J. *Chem. Eng. (London);* 620-623(Sep 1977).

A survey of recent development of the process and mineral industries in Australia includes a table of known resources of $U_3O_8$ and of planned production of uranium. Locations of the deposits are indicated on a sketch map.

**21112 Ford foundation report 'too optimistic' on US uranium supplies.** Marshall, P. *Nucl. Eng. Int.;* **22**: No. 261, 36-38(Aug 1977).

Delegates to the Uranium Institutes London Symposium on supply and demand heard two extremes of opinion over the extent of recovery of uranium reserves from representative of the Ford/Mitre Group and the National Academy of Sciences Panel. The Ford/Mitre group were accused of taking too optimistic a view. A more pessimistic attitude was shown by the Academy studies whose figures for projected annual uranium production, and uranium requirements are quoted.

**21113 Changing ideas on metallogenesis of Saskatchewan's uranium deposits.** Beck, L.S. (Saskatchewan Geological Survey). *Can. Min. J.;* **98**: No. 4, 49-50, 52(Apr 1977).

The supergene-hypogene controversy over the metallogenesis of Saskatchewan uranium ore deposits is reviewed. The author favors a metamorphic-hydrothermal origin for the Beaverlodge ores and a deep groundwater-hydrothermal origin for the unconformity deposits.

**21114 Mode of uranium occurrence in a migmatitic granite terrain, Baie Johan Beetz, Quebec.** Hauseux, M.A. (McGill Univ., Montreal, Quebec (Canada)). *CIM Bull.;* **70**: No. 780, 110-116(Apr 1977).

The geology of a uraniferous granite occurrence in eastern Quebec is dissected in detail.

**21115 New types of deposits will provide future supplies of uranium.** Derry, D.R. (Derry, Michener and Booth). *Can. Min. J.;* **98**: No. 3, 56-58, 60(Mar 1977).

Salient characteristics of worldwide types of uranium deposits are given. Percentages of reserves in each type are estimated for uranium at prices up to $30 per pound.

**21116 Distribution of clark uranium in terrigenous strata of Lower Carbonic period in the limits of the Orenburg region.** Danchev, V.I.; Kuznetsov, V.G. (AN SSSR, Moscow. Inst. Geologii Rudnykh Mestorozhdenij, Petrografii, Mineralogii i Geokhimii). *Izv. Vyssh. Uchebn. Zaved., Geol. Razved.;* No. 4, 62-67(Apr 1976). (In Russian).

By comparing the sections of the lower Carboniferous rocks of the Orenburg Region (those of the 'Arch' Mountains and Kama-Kinel Depression) a conclusion has been drawn that in spite of the significant difference in thickness and composition of the rocks, a sedimentation process trend remains common. Common for both sections is also an increase in radioactivity of the rocks from lower horizons (e.g., Elkhov horizon) to upper beds (e.g., Bobrik horizon). The radioactivity increase is probably due to the fact that a humus component in organic matter of sedimentary rocks, which is the most active concentrator of uranium, becomes all the more important (in coals of the Bobrik horizon of the Arch sections, the uranium content attains $10^{-3}$%). As has been found through comparing the data, the 'Arch' rock sections are much more notable for a higher radioactivity than those of the Kama-Kinel Depression. This can be explained by their paleogeographic position, i.e., shallow waters, proximity to continental mineral sources. Typical of these sections are coal interlayers with a relatively high uranium content.

**21117 Mechanism of strata infiltration ore deposition.** Shmariovich, E.M. *Sov. Geol.;* No. 2, 80-89(Feb 1976). (In Russian).

Using the data of thermodynamics and mineralogico-geochemical observations, the authors have ascertained the deposition conditions of uranium and associated minerals from infiltration waters in places where limonitization zones are pinching out. The sections where deposition of uranium from infiltration waters occurs are localized in the region of low positive and negative values of Eh. This factor facilitates a more or less complete extraction of uranium by any rocks containing carbonaceous matter. The value of departure of the uranium accumulation zone from a zone of limonitization in a profile of the oxidizing ore-controlling zonality is governed by a combination of active concentrations of uranium and ions $CO_3^{2-}$ in waters and the reducing properties of the country rocks. Moreover, the less are the first and third indicators and the greater is the second parameter, the higher is the value of departure. The same factors are found to control the morphology of the ore bodies.

## EXPLORATION

*REFER ALSO TO CITATION(S) 21920, 21933, 21934*

**21118 (DPST—77-146-2) Savannah River Laboratory Hydrogeochemical and Stream Sediment Reconnaissance. Preliminary raw data release: Spartanburg 1° x 2° NTMS area, North Carolina and South Carolina. National Uranium Resource Evaluation Program.** Heffner, J.D.; Ferguson, R.B. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Dec 1977. Contract EY-76-C-09-0001. 237p. (GJBX—9(78)). NTIS, PC E11/MF A01.

Preliminary results are presented of stream sediment and ground water reconnaissance in the Spartanburg National Topographic Map Series (NTMS) 1° x 2° quadrangle. Stream sediment samples were collected from small streams at 1202 sites for a nominal density of one site per 13 square kilometers (five square miles) in rural areas. Ground water samples were collected at 771 sites for a nominal density of one site per 25 square kilometers (ten square miles). Neutron activation analysis (NAA) results are given for uranium and 16 other elements in sediments, and for uranium and 9 other elements in ground water. Field measurements and observations are reported for each site. Analytical data and field measurements are presented in tables and maps. Statistical summaries of data and a brief description of results are given. A generalized geologic map and a summary of the geology of the area are included. Key data are presented in page-sized hard copy. Supplementary data are on microfiche. Key data from stream sites include (1) water quality measurements (pH, conductivity, and alkalinity), (2) elements that may be related to potential uranium and thorium mineralization in this area (U, Th, Hf, Ce, and Dy), and (3) elements useful for geologic classification of the sample area (Ti, V, Fe, Mn, A, and Sc). Supplementary data from stream sites include sample site descriptors (stream characteristics, vegetation, stream width, etc.) and additional elemental analyses that may be useful (F, Eu, Sm, La, Yb, and Lu). Key data from ground water sites include (1) water chemistry measurements (pH, conductivity, and alkalinity) and (2) elemental analyses (U, Na, Cl, Mg, Al, Mn, Br, V, and F). Supplementary data include site descriptors, information about the collection of the samples (well age, well depth, frequency of use of well, etc.), and analytical data for dyprosium.

**21119 (DPST—77-363) Field manual for stream water and sediment reconnaissance.** Ferguson, R.B.; Price, V.; Baucom, E.I. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Nov 1977. Contract EY-76-C-09-0001. 80p. (GJBX—80(77)). Dep. NTIS, PC A05/MF A01.

A manual is presented that is intended to direct and coordinate field operations, site selection, sample collection, and information codes for the Savannah River Laboratory (SRL) contribution to the National Uranium Resource Evaluation (NURE) program. The manual provides technical direction and public relations information for field sampling teams. The program is being conducted to evaluate domestic uranium resources and to identify favorable areas for commercial exploration. The NURE program is expected to increase

the activity of commercial exploration for uranium in the United States. (JRD)

**21120** (GJBX—3(78)) **Preliminary study of the uranium favorability of granitic and contact-metamorphic rocks of the Owens Valley area, Inyo and Mono Counties, California, and Esmeralda and Mineral Counties, Nevada.** Cupp, G.M.; Mitchell, T.P. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Jan 1978. Contract EY-76-C-13-1664. 54p. NTIS, PC E03/MF A01.

Granitic and contact-metamorphic rocks of the Owens Valley area were sampled to determine their favorability for uranium. Uranium deposits associated with these rocks were examined to determine the mode of occurrence. Metamorphic rocks near contacts with intrusive rocks include skarns, schists, quartzites, metaconglomerates, hornfels, gneisses, and metavolcanics. The grade of contact metamorphism ranges from slight to intense, depending upon the distance from the intrusive contact. The average $U_3O_8$ content of the metamorphic rock samples is 3 ppM. Metamorphic rock samples in a roof pendant at the Claw prospect contain as much as 3 percent $U_3O_8$. Skarn samples from the Birch Creek pluton contain as much as 114 ppM $U_3O_8$; those from the Santa Rita Flat pluton contain as much as 23 ppM $U_3O_8$. Most of the intrusive rocks are granite, quartz monzonite, or monzonite. Granodiorite and diorite are less common, and gabbro is rare. The average $U_3O_8$ content of the crystalline rock samples is 4 ppM. Samples from a quartz-monzonite pluton east of Lone Pine, California, and quartz monzonite in the Santa Rosa Hills had maximum contents of 28 and 13 ppM $U_3O_8$, respectively. Areas of contact metamorphism and metasomatism, such as those at the Claw prospect and Birch Creek pluton, are probably the most favorable sites for uranium deposits. There are many miles of granitic and contact-metamorphic zones in which undiscovered uranium deposits may exist. Although the overall uranium content of granitic rocks appears to be low, the pluton east of Lone Pine and the Hunter Mountain pluton in the area of the Santa Rosa Hills have sufficient uranium to have acted as uranium and detrital source rocks for uranium deposits that may now be buried in Tertiary sediments in the basins around the plutons. The Claw deposit is the only known uranium deposit of a size and grade to be of possible commercial interest.

**21121** (GJBX—7(78)) **Preliminary study of uranium favorability of the Wilcox and Claiborne Groups (Eocene) in Texas.** Wilbert, W.P.; Templain, C.J. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Jan 1978. Contract EY-76-C-13-1664. 101p. NTIS, PC E06/MF A01.

Rocks of the Wilcox and Claiborne Groups crop out in the Texas Gulf Coastal Plain and are represented by a series of sands and shales which reflect oscillation of the strandline. The Wilcox Group (lower Eocene), usually undifferentiated in Texas, consists of very fine sands and clays and abundant lignite. The Claiborne Group (middle Eocene) comprises, in ascending order, Carrizo Sand, Reklaw Formation (clay), Queen City Sand, Weches Formation (clay), Sparta Sand, Cook Mountain Formation (clay), and Yegua Formation (sand). Fluvial systems of the Wilcox and Claiborne Groups exist in east Texas and trend perpendicular to the present coastline. In central Texas, sand bodies are parallel to the present coastline and are strand-plain, barrier-bar systems. Since the time of deposition of the Queen City Sand, a significant fluvial sand buildup occurred in the area of the present Rio Grande embayment where the marine clays pinch out. Known occurrences of mineral matter in the Wilcox and Claiborne (up to the Yegua) are limited to lignite (particularly in the Wilcox), cannel coal in the upper Claiborne, and hydrocarbons throughout. No uranium mineralization is known, and no uranium is likely to be discovered in the Claiborne and Wilcox. Approximately 50 surface samples and many gamma-ray logs showed no significant anomalies. The sands are very good potential host rocks, but no uranium source was discovered. During deposition of the Wilcox and Claiborne Groups, there was no volcanism to serve as a source of uranium (as with the prolific occurrences in the younger rocks of south Texas); also, Precambrian crystalline rocks in the Llano uplift were not exposed.

**21122** (GJBX—78(77)) **Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico.** Vizcaino, H.P.; O'Neill, A.J. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Dec 1977. Contract EY-76-C-13-1664. 30p. MF A01.

Portions of document are illegible.

Three formations in the Tertiary of the San Juan Basin were investigated for their uranium favorability. They are the Ojo Alamo Sandstone, the Nacimiento Formation, and the San Jose Formation. The study comprised a literature survey and a basin analysis, which consisted of subsurface lithofacies, stratigraphic, and radiometric mapping. Field work in preparation for the subsurface analysis consisted of examination of outcrop and measured sections, surface radiometric traverses, and checking of reported surface radioactive anomalies. Interpretation of subsurface mapping provided the primary basis for favorability assessment. The sandstone trends depicted in lithofacies maps, and stratigraphic cross sections reflect large channel complexes and major fluvial systems originating in favorable source areas. Although surface radioactivity anomalies were found to be few, weak, and widespread, the San Juan Basin has abundant favorable host rocks. The subsurface anomalies, although weak, are widespread and sometimes persist throughout thickness intervals greater than 50 ft. Subsurface anomalies were mapped on a wide-spaced grid and are generalized. On the basis of apparent source, lithology, differential permeability, contents of carbonaceous detritus, and geometry, the Nacimiento Formation and the basal facies of the San Jose Formation in the north-central basin have the greatest potential. The Ojo Alamo Sandstone is less favorable, and the Nacimiento Formation in the southern part of the basin and the upper San Jose Formation are the least favorable of the units studied.

**21123** (GJBX—82(77)) **Preliminary study of favorability for uranium of the Sangre de Cristo Formation in the Las Vegas basin, northeastern New Mexico.** May, R.T.; Strand, J.R.; Reid, B.E.; Phillips, W.R. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Dec 1977. Contract EY-76-C-13-1664. 46p. MF A01.

Portions of document are illegible.

Uranium favorability of the Sangre de Cristo Formation (Pennsylvanian-Permian) in the Las Vegas basin has been evaluated. The Las Vegas basin project area, located in Colfax, Mora, and San Miguel Counties, New Mexico, comprises about 3,489 sq mi. The formation contains sedimentologic and stratigraphic characteristics that are considered favorable for uranium deposition. Field investigations consisted of section measuring, rock sampling, and ground radiometric reconnaissance. North-south and east-west cross sections of the basin were prepared from well logs and measured sections. Petrographic, chemical, and spectrographic analyses were conducted on selected samples. Stratigraphic and sedimentologic information were used to determine depositional environments. The most favorable potential host rocks include red to pink, coarse-grained, poorly sorted, feldspathic to arkosic lenticular sandstones with stacked sandstone thicknesses of more than 20 ft and sandstone-to-shale ratios between 1:1 and 2:1. The sandstone is interbedded with mudstone and contains carbonaceous debris and anomalous concentrations of uranium locally. Areas of maximum favorability are found in a braided-stream, alluvial-plain depositional environment in the north-central part of the Las Vegas basin. There, carbonaceous material is well preserved, probably due to rapid subsidence and burial. Furthermore, uranium favorability is highest in the lower half of the formation because carbonaceous wood and plant fragments, as well as known uranium deposits, are concentrated in this zone. Piedmont deposits in the north and east, and meander-belt, alluvial-plain deposits in the south, are not considered favorable because of the paucity of uranium deposits and a minimum of carbonaceous material.

**21124** (GJBX—92(77)) **Preliminary study of the uranium favorability of tertiary rocks, southeastern Oregon: eastern Klamath, Southern Lake, Harney, and western Malheur Counties.** Erikson, E.H.; Curry, W.E. (Bendix Field Engineering Corp., Grand Junction, Colo. (USA)). Nov 1977. Contract EY-76-C-13-1664. 24p. MF A01.

Portions of document are illegible.

Southeastern Oregon contains a thick Tertiary succession of intertonguing mafic to silicic volcanic rocks and volcanic-derived sediments that overlie a poorly exposed pre-Tertiary eugeosynclinal basement. In the Lakeview uranium district and elsewhere in the study area, rhyolitic magma invaded the Tertiary section. Based upon this reconnaissance study and limited subsurface information, only the lower Cedarville Formation contains sedimentary rocks that have characteristics favorable for the formation of supergene uranium deposits. However, beyond the immediate vicinity of known uranium prospects and mines, anomalous uranium concentrations were not detected in any sedimentary rocks. Tertiary sedimentary rocks of poorly known character and thickness underlie a Holocene alluvial cover in Catlow Valley, Goose Lake Valley, Harney Basin, and Pueblo Valley. The favorability of these buried sedimentary rocks cannot be completely evaluated with the data available. However, in Catlow Valley and Harney Basin, available well-log information, the character of the exposed sedimentary and silicic volcanic rocks, and the lack of known uranium occurrences suggest that these two areas are not favorable for sandstone uranium deposits. Anomalous concentrations of uranium have been detected in: (1) rhyolite plugs adjacent to the Lakeview uranium deposits, (2) an ash-flow tuff in southwestern Harney County, (3) rhyolites of the Pike Creek Formation near the Steens Mountain uranium prospects, and (4) a number of widely distributed silicic hypabyssal eruptive centers. It appears that rhyolitic plugs are the source of uranium in the Lakeview district.

**21125** (K/UR—3(Pt.5)) **National Uranium Resource Evaluation Program. Hydrogeochemical and Stream Sediment Reconnaissance Program in Central United States. Fourth quarter FY-1977, July 1—September 30, 1977.** Arendt, J.W. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 18 Nov 1977. Contract W-7405-ENG-26. 17p. Dep. NTIS, PC A02/MF A01.

The reconnaissance sampling program for the Oak Ridge Gaseous Diffusion Plant (ORGDP) Uranium Resource Evaluation (URE) Project continued along the Texas Gulf Coast in San Antonio and Seguin Quadrangles; in Northwest Texas in the Plainview Quadrangle; and in Wisconsin in Eau Claire, Green Bay, Iron Mountain, and Rice Lake Quadrangles.

**21126 Central ore dressing plant possible as Karoo uranium prospecting builds up.** Treasure, T. (Department of Mines, Pretoria (South Africa). Geological Survey). *S. Afr. Min. Eng. J.;* **88**: No. 4133, 45, 47, 49(Oct 1977).

A large number of small deposits of uranium have been established in the Karoo and the search is intensifying for a commercially-viable proposition. A multiplicity of geological disciplines are being concentrated in the Karoo Basin to determine whether uranium hopes for the area are well-founded. This article discusses the Geological Survey's uranium search.

**21127 State may assist in making small Karoo uranium deposits viable.** Treasure, T. (Department of Mines, Pretoria (South Africa). Geological Survey). *Coal, Gold Base Miner. South. Afr.;* **25**: No. 9, 97, 101, 143(Sep 1977).

A large number of small deposits of uranium have been established in the Karoo and the search is intensifying for a commercially-viable proposition. A multiplicity of geological disciplines are being concentrated in the Karoo Basin to determine whether uranium hopes for the area are well-founded. This article discusses the Geological Survey's uranium search.

**21128 Field surveys using a portable gamma ray scintillometer.** McDermott, M. (C.C. Hawley and Assoc Inc). *West. Miner;* **50**: No. 8, 16-17, 19-20(Aug 1977).

A portable gamma ray scintillometer, the GeoMetrics/Exploranium Model GR-101 A, was evaluated in the field and applied to several common problems encountered in uranium exploration. In order to better understand these applications, a brief discussion is presented covering the operation of such instruments, the principles of radioactivity and recommended field procedures. A survey was conducted to illustrate these applications and procedures.

**21129 Reconnaissance-level geochemical and radiometric exploration data from the vicinity of the Rabbit Lake uranium deposit.** Cameron, E.M.; Ballantyne, S.B. (Geological Survey of Canada, Ottawa, Ontario). *CIM Bull.;* **70**: No. 781, 76-85(May 1977).

Reconnaissance radiometric and geochemical data have been obtained for an area on the western shore of Wollaston Lake that includes the Rabbit Lake uranium deposit. Center-lake sediments and surface waters were analyzed for a variety of elements and other constituents. The airborne radiometric data comprise measurements of eU, eTh and K. Uranium in lake sediments and uranium in waters are the most effective geochemical indicators of uranium mineralization; the other elements measured are not notably anomalous. The use of sediments is generally favored for broad-scale reconnaissance in the region. The most effective radiometric indicator of the mineralization is the eU/eTh ratio.

**21130 Geochemical exploration for uranium in the Grenville province of Ontario.** Coker, W.B.; Jonasson, I.R. (Geological Survey of Canada, Ottawa, Ontario). *CIM Bull.;* **70**: No. 781, 67-75(May 1977).

A helicopter-mounted lake-sediment and lake-water survey was carried out over Grenville rocks in the Renfrew area. Lake-sediment and lake-water samples were collected from every body of water on which the helicopter could land. Surface and bottom water pH, dissolved oxygen content, conductivity and temperature were measured. Lake sediments and waters were analyzed for U, Mo, Cu, Zn, Pb, Fe, Mn, Ni, and Co. The organic content of the sediments was determined. A close relationship was found between bodies of granitic, syenitic and pegmatitic bedrock and elevated U levels in the lake sediments.

**21131 Geochemical methods applied to uranium exploration in southwest Baffin Island.** Maurice, Y.T. (Geological Survey of Canada, Ottawa, Ontario). *CIM Bull.;* **70**: No. 781, 96-103(May 1977).

A geochemical orientation survey was undertaken in an area in southwest Baffin Island. A methodology was established for a future reconnaissance geochemical program using lake samples. Mineralogical and chemical studies of known radioactive occurrences, combined with detailed sampling of secondary environment media in the vicinity of the showings, indicate that uranium is the most significant pathfinder, despite considerable enrichment of other metals in the uraniferous rocks. Significant geochemical patterns produced by uranium in lake waters and uranium in lake sediments have been obtained, but their relative usefulness depends on the distribution of carbonate bedrock. The base metal potential of the area was examined in some detail and found to be significant.

**21132 Alpha-particle autoradiography of geological specimens by use of cellulose nitrate detectors.** Basham, I.R.; Easterbrook, G.D. (Inst of Geol Sci, London, Engl). *Inst. Min. Metall., Trans., Sect. B;* **86**: B96-B98(May 1977).

For many years photographic nuclear emulsions have been the conventional medium for recording $\alpha$-particle emission from geological materials as an aid to the location and identification of uranium- and thorium-bearing phases. Recent advances in the application of solid-state nuclear-track detectors (SSNTD) have allowed an alternative method, with several important advantages, to be employed. Cellulose nitrate, in flexible sheet form, is used for $\alpha$-particle detection in a wide range of applications, including nuclear-reactor rate measurements, autoradiography of irradiated materials and biological specimens, and radon dosimetry in mines. The value of this detector in the location of uranium and/or its daughter products in ore has already been demonstrated. The record, presented here, of findings in current investigations in the Institute of Geological Sciences is intended to draw to the attention of potential users the advantages of a technique that requires little or no special equipment, laboratory or darkroom facilities. 5 refs.

**21133 Prospects for uranium exploration on a national scale.** Charlet, J.M.; Dupuis, C.; Quinif, Y. (Fac Polytech de Mons, Belg). *Ann. Mines Belg.;* No. 5, 521-531(May 1977). (In French and Flemish).

Having considered uranium supplies from an economic standpoint, the authors examine the most recent prospecting techniques which could lead to the discovery of new deposits. Underground radiometric anomalies in Belgium are surveyed indicating the content of the radioactive elements that was obtained with the help of gamma-ray spectrometry. A novel method for mapping the anomalies is presented. 24 refs.

**21134 Uranium.** Williams, R.M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Energy Sector). *Can. Min. J.;* **98**: No. 2, 145, 147, 149, 153, 156-158, 160(Feb 1977).

Strong uranium demand in 1976 gave impetus to nation-wide exploration programs and mill expansions, which are described. Governmental policies on safeguards and royalties are explained, and markets and prices analyzed.

**21135 Radioactive halos as possible indicators for geochemical processes in magmatites.** Meier, H.; Hecker, W. (Staatliches Forschungsinstitut fuer Geochemie, Bamberg, Ger.). *Geochem. J. (Nagoya);* **10**: No. 4, 185-195(Dec 1976).

In systematic microscopic measurements completed by fission track studies the occurrence of polonium halos and polonium bands could be confirmed in biotites of different areas. The abundance of the different types of polonium halos is given by the order $^{210}Po > {}^{218}Po > {}^{214}Po$. As magmatic and often also hydrothermal mechanisms are contrary to geological evidences a supergene hypothesis has been supposed for the genesis of the polonium halos. According to this mechanism polonium isotopes are accumulated out of uranium- or radium-bearing solutions which are liberated from rocks by leaching processes of percolating weathering waters. The concept of the given origin of polonium halos may be significant in discussing problems of dating, uranium prospection and the origin of secondary uranium deposits.

**21136 Mobile helium sniffer for petroleum, uranium and geothermal prospecting.** Friedman, I.; Denton, T.; Roberts, A.A.; Reimer, G.M. (Geological Survey, Denver, Colo. (USA)). pp 443-444 of In Third international conference on geophysics of the Earth and the oceans. Vol. 2. Canberra, Australia; Australian Academy of Science (1976).

From 3. conference on geophysics of the earth and the oceans; Sydney, Australia (16 Aug 1976).

See CONF-7608117—.

## MINING

*REFER ALSO TO CITATION(S) 21216*

## FEED PROCESSING

*REFER ALSO TO CITATION(S) 21109, 21134, 21179, 21201, 21206, 21207, 21212, 21702, 22197*

**21137 Uranium ore crushing.** Ricou, J. (Societe Stein Industrie, 75 - Paris (France)). *Tech. Mod.;* **69**: No. 3, 41-43(Mar 1977). (In French).

An industrial plant, situated in Niger, is described. This plant allows the crushing of 1500 metric tons of uranium per year in uranate form.

**21138 Method to recover uranium from uranium-containing phosphate ores.** Wirth, G.; Milde, W. (to Uranerzbergbau G.m.b.H. und Co. K.G.). German(FRG) Patent 2,531,958/A/. 10 Feb 1977. 11p. (In German).

As sulphuric acid is not always available for the decomposition of phosphate ores to obtain the bonded uranium, a suggestion is made to use a suitable organic acid for the decomposition, in particular oxalic acid. The released uranium is then leached in the known manner using soda and sodium bicarbonate and extracted from this solution. The decomposed apatite can be used as fertilizer.

**21139 Uranium refining process using ion exchange membrane.** Yamaguchi, A. (Asahi Chemical Industry Co. Ltd., Osaka (Japan)). *Karyoku Genshiryoku Hatsuden;* **28**: No. 1, 13-20(Jan 1977). (In Japanese).

As for the method of refining uranium ore being carried out in Europe and America at present, uranium ore is roughly refined at the mine sites to yellow cake, then this is transported to refineries and refined by dry method. This method has the following faults, namely the number of processes is large, it requires expensive corrosion-resistant materials because of high temperature treatment, and the impurities in uranium tend to increase. On the other hand, in case of EXCER method, treatment is carried out at low temperature, and high purity uranium can be obtained, but the efficiency of electrolytic reduction process is extremely low, and economically infeasible. In the wet refining method called PNC process, uranium tetrafluoride is produced from uranium ore without making yellow cake, therefore the process is rationalized largely, and highly economical. The electrolytic reduction process in this method was developed by Asahi Chemical Industry Co., Ltd. by constructing the pilot plant in Ningyotoge Mine. The ion exchange membrane, the electrodes, and the problems concerning the process and the engineering for commercial plants were investigated. The electrolytic reduction process, the pilot plant, the development of the elements of electrolytic cells, the establishment of analytical process, the measurement of the electrolytic characteristics, the demonstration operation, and the life time of the electrolytic diaphragm are reported.

## ENRICHMENT

**21140** (COO—3498-30) **New advances in isotope separation.** Bigeleisen, J. (Rochester Univ., N.Y. (USA). Dept. of Chemistry). 1977. Contract EY-76-S-02-3498. 25p. (CONF-760887—2). Dep. NTIS, PC A02/MF A01.

From Symposium on new advances in isotope separation; San Francisco, CA, USA (Aug 1976).

The commercialization of isotope separation procedures and recommendations on research needs in process development are reviewed. (JSR)

**21141** (COO/4295—1) **Uranium atoms and ions in the gas phase. Progress report, March 1, 1977—February 28, 1978.** Fite, W.L. (Pittsburgh Univ., Pa. (USA)). Oct 1977. Contract EN-77-S-02-4295. 7p. Dep. NTIS, PC A02/MF A01.

Work directed toward understanding associative ionization reactions of uranium atoms in the gas phase with gases, and subsequent reactions of ions formed by associative ionization reactions with other gases is reported. Processes are being investigated which either might be used in the separation of uranium isotopes (and other isotopes which can engage in associative ionization) or which affect other isotope separation methods (such as laser isotope separation methods). Research is reported devoted to electron spectroscopy of electrons produced in associative ionization reactions; measurement of the absolute collision cross sections, where associative ionization is used to monitor the absolute number density in a U atom beam, and study of ion-molecule reactions or uranium oxide ions. Studies of electron energy distribution show that electrons in the $U + O_2$ reaction are produced with very low energies, implying that the $UO_2^+$ ions are formed in very highly excited states. Collision cross section measurements indicate that the cross section for producing $U^+$ is somewhat smaller than anticipated having a peak cross section of about $6.5 \times 10^{-16}$ cm$^2$ at an electron energy of about 30 eV. Double cross beam experiments are in progress to clarify results of $UO_2^+ + NO_2$ ion-molecule reactions. (JRD)

**21142 Method for separation and enrichment of isotopes.** Kakihana, H.; Miyamatsu, T. (to Mitsubishi Rayon Co., Ltd.). US Patent 4,059,670. 22 Nov 1977. Priority date 9 Dec 1974, Japan. 8p.

Boron or uranium isotopes can be chemically separated and enriched with high speed and with high separating efficiency by using weakly basic anion exchange fibers having a diameter of not more than 100 μ, an aspect ratio of at least 5 and an exchange capacity of at least 2 meq/g-dry fiber, which are packed in a column at a specific volume of 2.0 to 20.0 ml/g-dry fiber.

### LASER EXCITATION

*REFER ALSO TO CITATION(S) 22315*

**21143 Laser isotope separation.** Yamashita, M.; Kashiwagi, H. (Ministry of International Trade and Industry, Tokyo (Japan)). *Denshi Gijutsu Sogo Kenkyusho Chosa Hokoku;* No. 188, 1-2, 1-29(Aug 1976). (In Japanese).

The recent development of technology concerning the wide tunability and narrow spectral width of a laser has made it possible to enrich and separate only one of desired groups of isotopic species efficiently through the selective excitation by the laser. It is the purpose of this report to review the work on the isotope separation by means of lasers, which has been rapidly developed since 1970, and to point out the future direction with particular attention to the application of the separation process to isotopic species related to atomic energy materials including radioisotopes. The report consists of four chapters. Chapter I describes the social needs for the isotope separation and some advantages of the methods for laser isotope separation over the conventional ones. Chapter II presents some conditions which the atomic or molecular isotopes, to be enriched or separated, and the lasers to be used are required to possess. In addition, the relation between the isotope shift and the optical spectra in atoms and molecules is discussed. In Chapter III is reviewed the published laser isotope separation of uranium by photoionization, hydrogen and sulfur by molecular photodissociation, and chlorine by photochemical reaction. The principle, advantages and problems of these methods are also discussed according to a classification of the methods by the difference of separation processes after the selective laser-excitation of isotopic species. All the isotopic species published as what have been enriched or separated so far by the laser methods are tabulated. In Chapter IV it is pointed out that the laser methods are suitable for enrichment or separation of isotopes of the fuel of thermal nuclear fusion such as lithium and radioisotopes such as plutonium. As the result of the review, a few new methods for laser isotope separation are proposed.

## FUELS PRODUCTION AND PROPERTIES

*REFER ALSO TO CITATION(S) 21232, 21574, 21576*

**21144** (ORNL/TM—6136) **Criticality considerations for $^{233}$U fuels in an HTGR fuel refabrication facility.** McNeany, S.R.; Jenkins, J.D. (Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. (USA). Dept. of Aerosol Physics). Jan 1978. Contract W-7405-ENG-26. 55p. NTIS, PC A05/MF A01.

Eleven $^{233}$U solution critical assemblies spanning an H/$^{233}$U ratio range of 40 to 2000 and a bare metal $^{233}$U assembly have been calculated with the ENDF/B-IV and Hansen-Roach cross sections. The results from these calculations are compared with the experimental results and with each other. An increasing disagreement between calculations with ENDF/B and Hansen-Roach data with decreasing H/$^{233}$U ratio was observed, indicative of large differences in their intermediate energy cross sections. The Hansen-Roach cross sections appeared to give reasonably good agreement with experiments over the whole range; whereas the ENDF/B calculations yielded high values for k/sub eff/ on assemblies of low moderation. It is concluded that serious problems exist in the ENDF/B-IV representation of the $^{233}$U cross sections in the intermediate energy range and that further evaluation of this nuclide is warranted. In addition, it is recommended that an experimental program be undertaken to obtain $^{233}$U criticality data at low H/$^{233}$U ratios for verification of generalized criticality safety guidelines. Part II of this report presents the results of criticality calculations on specific pieces of equipment required for HTGR fuel refabrication. In particular, fuel particle storage hoppers and resin carbonization furnaces are criticality safe up to 22.9 cm (9.0 in.) in diameter providing water or other hydrogenous moderators are excluded. In addition, no criticality problems arise due to accumulation of particles in the off-gas scrubber reservoirs provided reasonable administrative controls are exercised.

**21145 Transmission electron microscopy of pyrocarbon coatings.** Pollmann, E.; Pelissier, J.; Yust, C.S.; Kaae, J.L. (Kernforschung Juelich, Inst fuer Reakt, Ger). *Nucl. Technol.;* **35**: No. 2, 301-309(Sep 1977).

Transmission electron microscopy reveals that the pyrolytic carbons deposited in a fluidized bed of particles are made up of growth features, the shapes of which vary with the deposition conditions. Three different microstructures, also varying with deposition conditions, are observed within the growth features. The microstructures are: a "mosaic" structure composed of tightly packed small carbon crystallites arranged with the (002) planes nearly parallel to the surface of the growth feature; a "tangled fiber" structure with carbon crystallites arranged with the (002) planes parallel to the axes of long, bent, or twisted ribbons or fibers; and a

"layered" structure composed of large crystallites only slightly misoriented from one another over fairly long distances.

**21146 Measurements of energy dependent Doppler factor for uranium dioxide using a lead slowing-down time spectrometer.** Fujino, M.; Takahashi, F. (At Energy Res Lab, Hitachi Ltd, Kawasaki-shi). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 416-425(Jun 1977).

The Doppler factor is herein defined as the ratio of neutron capture rate in the sample at the high temperatures T=450 and 300°C to that at the low temperature T=20°C. The Doppler factor measured at T=450 and 300°C showed the maximum values of 1.225 +- 0.044 and 1.186 +- 0.040, respectively around the resonance of 66.3 eV. In the energy region above about 200 eV, the Doppler factor decreased with increasing neutron energy. In the energy region below about 70 eV except for region around the resonance of 6.68 eV, the Doppler factor decreased with increasing neutron energy. 13 refs.

**21147 Measurement and analysis of neutron spectrum in spherical pile of thoria.** Nishihara, H.; Kimura, I.; Kobayashi, K.; Hayashi, S.A.; Yamamoto, S.; Nakagawa, M. (Kyoto Univ, Sakyo-ku, Jpn). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 426-437(Jun 1977).

The predicted spectra with ABBN and DLC-2D gave less flux by about 30% than the measured in the energy below about 100 keV, similar disagreement was observed only above 10 keV for the spectrum with NNM and the measured spectrum became about 20% lower than all of the predicted above 1 MeV. Neutron spatial distribution was measured by the activation method and the results showed spherical symmetry around a photoneutron target at the center of the pile. 25 refs.

**21148 Method and device for the dry preparation of ceramic uranium dioxide nuclear fuel wastes.** Pirk, H.; Roepenack, H.; Goeldner, U. (to Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM)). German(FRG) Patent 1,667,851/B/. 13 Jan 1977. 5p. (In German).

Reprocessing of waste, resulting from the production of ceramic sintered bodies from uranium dioxide for use as nuclear fuel, in a dry process into very finely dispersed pure $U_3O_8$ powder may be improved by applying vibrating screening during oxidation. An appropriate device is described.

**21149 Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient.** Sari, C. (Eur Inst for Transuranium Elem, EURATOM, Karlsruhe, Ger). *Nucl. Technol.;* **35**: No. 1, 145-153(1977).

Temperature gradients similar to those existing in high-rated MX-type fuel [UC, (U, Pu)C and (U, Pu)$C_{0.9}$ $N_{0.1}$] are obtained by heating cylindrical pellets with an alternating electrical current flowing in the axial direction. The power used and the heat impedance existing between the surface of the pellets and the cladding material is sufficient to produce average temperature gradients on the order of 150 kK/m in temperature regions between 1273 and 2273°K. Preliminary experiments show that under these temperature conditions, important restructuring of the MX-type fuel occurs after a comparatively short time. Generally, four structural zones, characterized by a temperature and a temperature gradient, are observed in cross sections of the heated specimens.

**21150 Study of uranium-plutonium carbide-based fuel simulating high burnup.** Benedict, U.; Giacchetti, G.; Matzke, Hj.; Richter, K.; Sari, C.; Schmidt, H.E. (Eur Inst for Transuranium Elem, EURATOM, Karlsruhe, Ger). *Nucl. Technol.;* **35**: No. 1, 154-161(1977).

Carbide-based fuels simulating high burnup were prepared by addition of inactive fission product elements. They contained fission product phases of the $UMoC_2$ and $U_2RuC_2$ type, and a rare-earth oxide phase. The thermal conductivity of the material is within the range observed for carbide-based fuels free of fission products. The diffusion of plutonium was considerably enhanced by the addition of fission products. The solid fission product swelling rate of a carbide-based fuel was estimated to be 0.5% per at.% burnup.

## SPENT FUELS REPROCESSING

*REFER ALSO TO CITATION(S) 21218, 21228, 21998*

**21151** (GA-A—14678) **Preliminary maintainability analysis of the HTGR dry head-end reprocessing systems.** Rode, J.S.; Strand, J.B. (General Atomic Co., San Diego, Calif. (USA)). Nov 1977. Contract EY-76-C-03-0167-053. 150p. Dep. NTIS, PC A07/MF A01.

A preliminary maintainability analysis was prepared for the HTGR dry head-end reprocessing systems. Most probable failure modes, failure mechanisms, corrective maintenance requirements and failure rates were identified for each of the systems. Maintainability network diagrams were prepared to identify all operations required to correct the failures. Maintenance activities were summarized, and major downtime contributors were identified for future design upgrading to reduce downtime.

**21152** (ORNL/TM—5866) **Reaction of uranyl nitrate solutions with amberlite IRC-72 cation exchange resin at 30°C: a kinetic investigation for the HTGR fuel recycle plant.** Shaffer, J.H.; Shockley, W.E.; Evans, R.B. III. (Oak Ridge National Lab., Tenn. (USA)). Jan 1978. 48p. NTIS, PC A03/MF A01.

A kinetic investigation of the reaction of uranyl nitrate solution with Amberlite IRC-72 cation exchange resin was conducted at 30°C under conditions similar to those anticipated for a High-Temperature Gas-Cooled Reactor fuel refabrication facility. A simplified mass transfer analogue expression was developed to evaluate the effects of process parameters on the resin loading rate. Correlation of the experimental data with the integrated rate expression depended only on the determination of the reaction velocity constant and the limiting distribution coefficient for uranium in the system. 5 tables, 4 figs.

**21153** (ORNL/TM—6092) **Advanced fuel recycle program progress report, July 1—September 30, 1977.** Unger, W.E. (comp.). (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 128p. .

This quarterly progress report on the Fuel Recycle Program covers the ongoing development program aimed at providing the technology for production-scale advanced fuels recycle. The continuing basic laboratory and hot-cell studies, engineering research, and component equipment development activities are in support of a cold integrated equipment test scheduled for 1981 and a current conceptual design of a hot experimental facility scheduled for operation in 1988.

**21154 Method for increasing the lifetime of an extraction medium used for reprocessing spent nuclear fuel and/or breeder materials.** Schmieder, H.; Stieglitz, L. (to Gesellschaft fuer Kernforschung mbH). US Patent 4,059,671. 22 Nov 1977. Priority date 18 Oct 1974, German, Federal Republic of (F.R. Germany). 8p.

A method is provided for increasing the lifetime of an extraction medium containing an organophosphorus acid ester and a hydrocarbon and being used for reprocessing spent nuclear fuel and/or breeder materials. Impurities resulting from chemical and/or radiolytic decomposition and interfering compounds of such impurities with radionuclides are removed from the extraction medium by bringing the extraction medium, after use, into intimate contact with an aqueous hydrazine hydrate solution having a concentration of between 0.1 and 1.0 molar at a temperature between 20 to 75°C. The aqueous hydrazine hydrate solution is then separated from the extraction medium.

**21155 Solvent extraction in the nuclear industry.** McKay, H.A.C.; Webster, R.K. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). *Chem. Ind. (London);* No. 17, 731-737(3 Sep 1977).

It is stated that the nuclear industry was a pioneer in the industrial use of solvent extraction for the separation and purification of metals. The separation of Pu in 1942 was the forerunner of a large number of applications of solvent extraction in the nuclear industry. These include the purification of U, the reprocessing of irradiated nuclear fuel, the separation of fission products and actinides, and the preparation of super-pure reactor grade materials such as Zr, Be, B, etc. Headings of the paper are as follows: reprocessing of spent nuclear fuels, status of commercial reprocessing in different countries (UK, France, Germany, United Reprocessors, USA, other countries); technical aspects of oxide fuel reprocessing, reprocessing of fast reactor fuel; general trends in reprocessing; some long term possibilities; Th fuel reprocessing; recoveries of secondary products in reprocessing (fission product, Np, Pu recovery from scrap; elimination of actinides from high level waste); and super-pure reactor materials.

**21156 Remotely controlled computer-guided preparation facility for X-ray fluorescence measurement samples at a fuel reprocessing plant.** Brodda, B.G.; Lammertz, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie); Maselter, H.; Vieth, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Allgemeine Technologie). *Kerntechnik;* **19**: No. 9, 433-444(Sep 1977). (In English and German).

This paper describes a facility by means of which liquid samples from the fuel reprocessing process are converted into a form suitable for measurement at one of two X-ray fluorescence spectrometers. Aliquots of the liquid samples are pipetted onto paper filters on a transport tape, the filters are recorded, dried, punched out, framed, stored in a provisional storage magazine, transported by means of a rabbit system from the shielded box into the measuring laboratory, checked for identification in a reading station and allocated to the measuring instruments. The facility is controlled electronically and pneumatically under guidance by a process computer.

**21157 Topical problems in reprocessing nuclear fuels.** Scheuten, G.H. *Energie;* **29**: No. 6, 173-175(Jun 1977). (In German).

In the Federal Republic of Germany, it is the reponsibility of the electric power industry as a result of the originator principle - to set the preconditions for the waste disposal of the nuclear power plants operated by it. The economic and political factors which render a reprocessing and waste treatment in the fuel cycle necessary, as well as an intermediary storage of irradiated fuel elements, are discussed and the tasks and targets of the nuclear industry are described.

**21158** (GERHTR—181) **Investigation of special resins for the extraction-chromatogaphic separation of Np and Pu from the process stream of a reprocessing plant for HTR fuel elements.** Ritter, G. Mar 1977. Translation of KFA-ICT-IB—412-77. 36p. Dep. NTIS, PC A03/MF A01.

Work performed under United States—German High Temperature Reactor Research Exchange Program.

The effectiveness of several special resins for extraction chromatographic separation of plutonium and neptunium from the process streams of a reprocessing plant was investigated. These special resins consisted of polystyrol and were loaded with Tri-n-octylamine (TOA) during the polymerization process. A commercial structural body of polytrifluormonochlorethylene (Voltalef), subsequently wetted with TOA, served as reference material. Despite its good separation characteristics, this separation body has considerable disadvantages. The individual particles of separation body are only approximately spherical, the homogeneity of the separation bed is consequently only moderate. This size (85% less than 0.062 mm) and the shape of the separation body particles cause high pressure loss in the solution which streams through. Filling the column with the Voltalef separation body is very complicated and often not reproducible. A relatively high elution rate of the stationary phase and low radiation resistance are other disadvantages of this separation body. Because of the unfavorable characteristics of the Voltalef separation body, the above mentioned polystyrol resins have been developed by the Bayer firm. The individual separation body particles of these resins have ideal spherical shape. The diameter of the spheres is 0.4 to 0.6 mm, causing only slight pressure losses in a chromatographic column. A homogeneous and compact column fill is much simpler to achieve with these resins than with Voltalef. Radiation resistance and elution rate of the polystyrol resins correspond to the expectations which must be met during hot operation. The separation characteristics of the investigated polystyrol resins are not optimum, however. The relatively large separation body particles considerably delay the establishment of equilibrium, for two reasons. The rate-determining step during loading is diffusion through an aqueous film, which surrounds the separation body particles.

**21159 In-line gas chromatograph for analysis of $UF_6$ and/or $F_2$.** Sugikawa, S.; Tsujino, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 2, 147-152(Feb 1977).

With the view of continuous analysis of $UF_6$ and/or $F_2$ in the fluorination of U for the development of the fluoride volatility process, an in-line gas chromatograph, made of anti-corrosive materials against the fluorides, has been constructed using two different columns and automatic sampling system. The separation columns used, were optimized for the simulated process gas composition (($N_2$, $O_2$, $F_2$)/($UF_6$)=18, ($N_2$, $O_2$)/($F_2$)=3.3), in order to obtain the complete peak separation. The column selected for $UF_6$ analysis is 0.4 cm phi Cu tubing of 3 m long packed with 40w/0 of poly-trifluoromonochloro-ethylene oil which is loaded on poly-tetrafluoro-ethylene powder. The column for $F_2$ analysis is the combination of the above column with a conversion column of 0.4 cm phi tubing of 2 m long packed with KCl powder. Under these column conditions, the analytical time is 9 and 3 min for $UF_6$ and $F_2$, respectively at the flow rate of 100 ml/min. The calibration curves are linear with a zero intercept, and the analytical limits are, respectively 0.2 and 1 mmHg in partial pressures of $UF_6$ and $F_2$ with 10 ml of sampling volume. In actual adaptation to the fluorination of uranium oxides, the in-line gas chromatograph was satisfactorily able to measure the reaction rate and to detect the end of fluorination.

**21160 Fuel elements for nuclear reactors from the cased chemical plant. High safety requirements on the reprocessing plant.** Schulze, K.P. *Hatsuden Suiryoku;* **30**: No. 2, 8(Jan 1977). (In German).

The newspaper article describes the principle of fuel element reprocessing, gives the design data of a plant to be erected in the FRG, and gives information of safety aspects.

**21161 Applying hafnium or hafnium alloys as material in plants for reprocessing irradiated nuclear fuels.** Poetzschke, M.; Schmieder, H.; Warnecke, E. (to Metallgesellschaft A.G.). German(FRG) Patent 2,520,870/A/. 18 Nov 1976. 14p. (In German).

Hafnium or alloyed hafnium are suitable as material for use in equipment for the reprocessing of irradiated nuclear fuel or breeding material containing uranium, plutonium or thorium. It has high corrosion resistance, high neutron absorption crossection and is easily deformable and easy to weld. The compositions of alloys, which are similarly suitable, are given. They contain, apart from hafnium, elements such as titanium, zirconium, niobium, tantalum or chromium, molybden, tungsten or vanadium.

## TRANSPORT AND STORAGE

*REFER ALSO TO CITATION(S) 22011*

**21162** (DOE/EV—0004) **Shipments of nuclear fuel and waste: are they really safe.** (Department of Energy, Washington, D.C. (USA). Div. of Environmental Control Technology). Oct 1977. 13p. Dep. NTIS, PC A02/MF A01.

The safety aspects of shipping nuclear fuels and radioactive wastes are discussed by considering: US regulations on the shipment of hazardous and radioactive materials, types of radioactive wastes; packaging methods, materials, and specifications; design of shipping containers; evaluation of the risk potential under normal shipping conditions and in accident situations. It is concluded that: the risk of public catastrophe has been eliminated by strict standards, engineering design safety, and operational care; the long-term public burden of not transporting nuclear materials is likely to be higher than the risks of carefully controlled transportation, considering the various options available; and the likelihood of death, injury, or serious property damage from the nuclear aspects of nuclear transportation is thousands of times less than the likelihood of death, injury, or serious property damage from more common hazards, such as automobile accidents, boating accidents, accidental poisoning, gunshot wounds, fires, or even falls. (LCL)

**21163 Feasibility of transporting nuclear fuel by air.** Webb, W.E. Jr.; Carlson, R.W. (Georgia Inst. of Tech., Atlanta). *Trans. Am. Nucl. Soc.;* **27**: 139-140(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## MARKETING AND ECONOMICS

*REFER ALSO TO CITATION(S) 21134*

**21164** (MR—168) **Uranium supply to 2000, Canada and the world.** Williams, R.M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Development Sector). 1976. 26p. Dep. NTIS (US Sales Only), PC A03/MF A01.

Annual world uranium demand is expected to increase 12-to 15-fold by the year 2000. In response to this demand, annual world production capacity will grow by 35 per cent to 44 000 tonnes of uranium by 1978. Further expansion is possible, contingent on early production decisions, sufficient to meet annual world requirements approaching 90 000 tonnes of uranium in 1985. Known low-cost uranium reserves do not provide sufficient forward reserves for production levels forecast beyond 1979, and known higher-cost reserves extend the satisfactory forward reserve position by only five years. Since 1965, Canada has dropped from first to fourth place, after Australia, South Africa, and the United States, in terms of low-cost, reasonably assured resources. Canada continues to rank second, after the United States, in terms of production. Canadian nuclear fuel requirements are expected to grow by 14 per cent a year, approaching 12,600 tonnes of uranium in 2000.

## WASTE MANAGEMENT

*REFER ALSO TO CITATION(S) 21162, 21206, 21702*

**21165** (DP—1468) **Low-pressure hydraulic technique for slurrying radioactive sludges in waste tanks.** Bradley, R.F.; Parsons, F.A.; Goodlett, C.B.; Mobley, R.M. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Nov 1977. Contract EY-76-C-09-0001. 31p. Dep. NTIS, PC A03/MF A01.

Present technology for the removal of sludges from radioactive liquid waste storage tanks at the Savannah River Plant (SRP) requires large volumes of fresh water added through high-pressure (~3000 psig) nozzles positioned to resuspend and slurry the sludge. To eliminate the cost of storing and evaporating these large volumes of water (several hundred thousand gallons per tank cleaned), a technique was developed at the Savannah River Laboratory (SRL) to use recirculating, radioactive, supernate solution to resuspend the sludge. The system consists in part of a single-stage centrifugal pump operating in the sludge at ~100 psia. Recirculating supernate is

drawn into the bottom of the pump and forced out through two oppositely directed nozzles to give liquid jets with a sludge-slurrying capability equal to that obtained with the present high-pressure system. In addition to eliminating the addition of large quantities of water to the tanks, the low-pressure recirculating technique requires only approximately one-sixth of the power required by the high-pressure system. Test results with clay (as a simulant for sludge) in a waste tank mockup confirmed theoretical predictions that jets with the same momentum gave essentially the same sludge-slurrying patterns. The effective cleaning radius of the recirculating jet was directly proportional to the product of the nozzle velocity and the nozzle diameter ($U_0D$). At the maximum $U_0D$ developed by the pump ($\sim$14 ft$^2$/s), the effective cleaning radius in the tank mockup was $\sim$20 feet.

**21166** (RFP—2458) **Summary report of soil removal preliminary excavations. (Report No. ES-389-75-171).** Wickland, C.E. (Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant). Jul 1975. Contract EY-76-C-04-3533. 38p. Dep. NTIS, PC A02/MF A01.

A proposed technique to remove small areas, <2,000 m$^2$, of contaminated soil is discussed along with the results of an actual excavation. Based on the results of a trial excavation in uncontaminated soil and an excavation of two trenches in contaminated soil, it is concluded that the techniques described are a satisfactory means of contaminated soil removal. It can be done safely with a release of airborne plutonium a factor of 10 or more below the Environmental Protection Administration (EPA) limit.

**21167** (SAND—77-7024) **Archaeological reconnaissance of a proposed site for the Waste Isolation Plant (WIPP).** Nielsen, J. (Sandia Labs., Albuquerque, N.Mex. (USA)). 27 Jul 1976. Contract EY-76-C-04-0789. 86p. MF A01.

An archaeological reconnaissance was carried out on Sections 20, 21, 28, and 29 of T 22 S, R 31 E, Eddy County, NM, the core area of a site proposed for disposal of radioactive waste in bedded salt (the Waste Isolation Pilot Plant). This site is located in the Los Medanos area east of Carlsbad, NM. Results of the survey are presented in sections on survey techniques, geology, terrain, floristics, cultural resources, theoretical considerations, site description, and recommendations. (JRD)

## WASTE PROCESSING

**21168** (AERE-R—8735) **Studies on the thermal decomposition of nitrates found in highly active waste and of chemicals used to convert the waste to glass.** Chun, K.S. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). May 1977. 35p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The decomposition of all the individual chemicals used in the Harwell inactive vitrification pilot plant has been studied by means of a thermal balance. Weight loss curves to 1100°C have been obtained. The four materials sodium nitrate, cesium nitrate, lithium nitrate and ruthenium nitroso-nitrate (solution) showed a greater weight loss than that based on an oxide yield, and hence these compounds or their products of decomposition are volatile below 1100°C. The remaining materials suffered a weight loss no more than that corresponding to a full yield of the oxide, and hence they were not volatile below 1100°C. Most of the chemicals begin to decompose at less than 75°C but the nitrates of cesium, strontium, barium and sodium not until 295° to 590°C. The results obtained can be used in the analysis of process conditions in the vitrification and calcination of highly radioactive wastes and also of the thermal decomposition behaviour of mixtures containing those materials. The materials tested were: $Al(NO_3)_3.9H_2O$, $Ba(NO_3)_2$, $CaNO_3$, $Cr(NO_3)_3.9H_2O$, $Fe(NO_3)_3.9H_2O$. $Mg(NO_3)_2.6H_2O$, $Ni(NO_3)_2.6H_2O$, R.E. Nitrates, Ruthenium Solution, $Sr(NO_3)_2$, $UO_2(NO_3)_2.6H_2O$, $Zn(NO_3)_2.6H_2O$. Zirconium Solution, 'Gasil WP' Silica, 'Neosyl' Silica, $LiOH.H_2O$. $LiNO_3.3H_2O$, $Na_2CO_3$, $NaNO_3$, $Na_2B_4O_7.10H_2O$.

**21169** (ICP—1132) **Technical Division quarterly progess report, July 1—September 30, 1977.** Slansky, C.M.; Musgrave, B.C.; Dickey, B.R.; Rohde, K.L. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Oct 1977. Contract EY-76-C-07-1540. 175p. Dep. NTIS, PC A09/MF A01.

Results are presented on the fluidized-bed calcination of simulated radioactive waste from the reprocessing of spent commercial nuclear fuel, on the post treatment of the calcine, and on the removal of actinide elements from the waste prior to calcination. Other programs include the development of storage technology for $^{85}Kr$ waste; a study of the hydrogen mordenite catalyzed reaction between NO/sub x/ and $NH_3$; the adsorption and storage of $^{129}I$ on silver exchanged mordenite; physical properties, materials of construction, and unit operations studies on the evaporation of high-level waste; the behavior of volatile radionuclides during the combustion of HTGR graphite-based fuel; and the use of the uranium-ruthenium system in age-dating uranium ore bodies. Results of work associated with special materials production are summarized. The long-term management of defense waste from the ICPP covers post-calcination treatment of ICPP calcinated waste; the removal of actinide elements from first-cycle raffinate; the retrieval and handling of calcined waste from ICPP storage vaults; and the preparation of the "Defense Waste Document". Process improvements are reported on the Fluorinel headend process for Zircaloy-clad fuels and on uranium accountability measurements. Other development results cover the process for recovering spent Rover fuel, buried pipeline transfer systems, support to the Waste Management Program, and effluent monitoring methods evaluation and development. Activities in other projects supporting energy development are outlined including studies on nuclear materials security; application of a liquid-solid fluidized-bed heat exchanger to the recovery of geothermal heat; inplant reactor source term measurements; burnup methods for fast breeder reactor fuels; absolute thermal fission yield measurements; analytical support to light water breeder reactor development; and the behavior of environmental species of iodine.

**21170** (ICP—1136) **Development of a fluidized-bed calciner and past-treatment processes for solidification of commercial fuel-reprocessing liquid wastes.** Schindler, R.E.; Berreth, J.R.; Simpson, G.G.; Valentine, J.H.; Walker, M.S. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office). Dec 1977. Contract EY-76-C-07-1540. 207p. Dep. NTIS, PC A11/MF A01.

The results of development efforts to adapt fluidized-bed-calcination technology, demonstrated by plant operation since 1963 with radioactive wastes at the ICPP Waste Calcining Facility, to the solidification of radioactive liquid wastes from the reprocessing of commercial nuclear-reactor fuels are presented. Pilot-plant calcining tests with simulated wastes verify the feasibility of fluidized-bed calcination of a variety of projected waste compositions. The status of development of metal-matrices and sintered glass-ceramics as alternative waste forms to glass is given. Development needs are presented for fluidized-bed calcination and for alternative waste forms.

**21171** (KFK—2431) **Development of an irradiation technology for the recycling of Am-241 in nuclear reactors. A contribution to the possibilities for the reduction of the hazard potential of $\alpha$-bearing wastes.** Gasteiger, R. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. fuer Angewandte Systemanalyse; Technische Univ. Muenchen (Germany, F.R.). Fachbereich Chemie, Biologie und Geowissenschaften). Jun 1977. 146p. (In German). Dep. NTIS (US Sales Only), PC A07/MF A01.

Thesis.

The report gives a detailed description of the irradiation technology for the recycling of Am-241 in nuclear reactors. The different steps i.e., design, manufacture, transport, and post-irradiation-examinations for the irradiation pins, as well as the irradiations themselves are discussed. The theoretical part of this report shows the possibilities for reduction of the hazard potential of radionuclides with respect to their recycling in nuclear reactors.

**21172** (MLM—2463) **Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April—June 1977.** Luthy, D.F.; Bond, W.H. (Mound Lab., Miamisburg, Ohio (USA)). 30 Nov 1977. Contract EY-76-C-04-3533. 8p. Dep. NTIS, PC A02/MF A01.

The Cyclone Incinerator development this quarter was concentrated on testing a particular liquid feed and burn system. The liquids tested were limited to tributyl phosphate in kerosene and oil-based vacuum pump oil. The tests established that the system worked as designed and built; that tributyl phosphate (TBP), as much as 30% by weight in kerosene, would burn readily; and that the scrubber system collects and neutralizes phosphoric acid which results from the combustion of TBP. Ash immobilization studies included determinations of leach rates for cemented ash. Plutonium-238 was used as a doping agent for the detection of leaching.

**21173** **Radiation effects on salt relevant to nuclear waste disposal in salt deposits.** Verkerk, B. (Stichting Energieonderzoek Centrum Nederland, Petten). *Energiespectrum;* **1**: No. 9, 258-261(Sep 1977).

A discussion is presented of the physical and chemical radiation effects, mainly of gamma radiation, on sodium and potassium chloride (in laboratory experiments) as well as on salt in geological deposits. Resulting crystal lattice defects and stored energy are the physical aspects; dissociation and radiolysis form the chemical part.

**21174** **Radioactive waste disposal: low and high level.** Gilmore, W.R. (ed.). Park Ridge, NJ; Noyes Data Corp. (1977). 379p.

The technology being developed to concentrate and immobilize both high-level and low-level radioactive wastes so that they may be disposed or stored in a comparatively safe and compact manner according to accepted U.S. government nuclear guidelines is described. Most of the material presented deals with waste handling in the U.S.; however, a brief description of procedures followed in other countries is included. Present waste management practices at government nuclear facilities and commercial fuel processing plants are outlined, and schemes for waste management resulting from

advances in radioactive waste treatment technology are described. In addition to the references cited at the end of each chapter, an extensive bibliography of government reports and a glossary of abbreviations of nuclear and technical terms are included in the book. (BLM)

**21175 $SrTiO_3$ synthesis process for solidification of strontium-90.** Senoo, M. (Japan Atomic Energy Research Inst., Tokyo). *Nippon Genshiryoku Gakkaishi;* **18**: No. 12, 781-785(Dec 1976). (In Japanese).

A serial process is proposed for safe and economical synthesis of strontium titanate, which compound is suitable to prepare heat source using a radioactive nuclide, $^{90}Sr$, in fission products. The process is based on a method previously reported to synthesize the compound by calcining a mixture of strontium nitrate and metatitanic acid. In the process, the synthesis in a metalic apparatus is realized for enough low calcining temperature, and radioactive contamination level accompanied is much reduced. Although the density of the sintered ceramic products in the present process is lower than in the conventional method, the products can be practically used for heat source without any serious trouble presumed. The solidification of a large amount of radioactive strontium waste is possible in the same way by adopting the process.

**21176 Activation of water-soluble amines by halogenes for catching radioactive iodine out of air streams.** Deitz, V.R.; Blachly, C.H. (to Energy Research and Development Administration, Washington, D.C. (USA)). German(FRG) Patent 604,109/A/. 11 Nov 1976. 9p. (In German).

Charcoals impregnated with tertiary amine (e.g. tri-ethylene diamine) are suitable for adsorption of methyl iodide 131 from the gas flow of a nuclear reactor, but have a low ignition temperature. This can be increased if the impregnation of the charcoal is carried out using a solution, which also contains a halogen (iodine, bromine) as well as the tertiary amine. There should preferably be about 0.4 to 1.6% of halogen and 2 to 7% of tertiary amine present in the charcoal.

**21177 Recombinator of hydrogen and oxygen.** Stejskal, J.; Klein, O.; Scholtz, G.; Schmidt, P.; Olaussson, A. (to Decatox G.m.b.H., Frankfurt am Main (Germany, F.R.)). German(FRG) Patent 2,451,438/A/. 6 May 1976. 7p. (In German).

Improvements are proposed for the well known reactors for the catalytic recombination of hydrogen and oxygen, which should permit this being used in contiuous operation in nuclear reactors (BWRs). The improvements concern the geometric arrangement of gas-inlet and -outlet pipes, the inclination of the axis of the catalyst container and the introduction of remote operation.

**21178 Use of natural Uzbekistan zeolites for purification of low-level liquid waste. I. Sorption of radioactive cesium.** Vdovina, E.D.; Radyuk, R.I.; Sultanov, A.S. *Radiokhimiya;* **18**: No. 3, 422-423(May 1976). (In Russian).

The sorption properties of the zeolites, natrolite, lomontite, clinoptilolite, with respect to radioactive cesium and the dependence of the sorption on the degree of dispersion of the sorbent and the mass were investigated. It was established that the maximum sorption occurs on particles of a size $<0.1$ mm, with a consumption of the sorbent 1.0-2.0g/liter. Moreover, the greatest absorption capacity is exhibited by natrolite and clinoptilolite: 86 and 94%, respectively.

**21179 Problems in the separation of radium from uranium ore tailings.** Seeley, F.G. (Oak Ridge National Lab., TN). *Hydrometallurgy;* **2**: 249-263(1976).

The radium content of a representative sandstone type of uranium ore was found to be distributed uniformly according to particle size before leaching, but in sulfuric acid-leached tailings was found predominantly in the -325 mesh fraction. The radium leaching characteristics from both ore and sulfate-leached tailings were investigated. Several 1 M salt solutions showed poor to moderate $RaSO_4$ dissolution from "slimes solids" tailings, while 3 M $HNO_3$ or HCl solutions dissolved approximately 95% of the radium content of either ore or tailings. Tests are reported in which -325 mesh sand particles were coated with alkaline-earth sulfates by a special technique to simulate slime solids tailings. The dissolution of $RaSO_4$ from these coated sands was decreased by the presence of $BaSO_4$, but increased by the presence of $CaSO_4$. The interrelationships in the dissolution of mixtures of $CaSO_3$, $SrSO_4$, $BaSO_4$, and $RaSO_4$ are shown, and a generalized equation for the estimation of the dissolution of a minor component is presented.

## WASTE DISPOSAL AND STORAGE

*REFER ALSO TO CITATION(S) 21174, 21211, 22202, 22226, 22283*

**21180** (DP—1476) **Materials aspects of SRP waste storage: corrosion and mechanical failure.** Donovan, J.A. (comp.). (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). Nov 1977. Contract EY-76-C-09-0001. 48p. Dep. NTIS, PC A03/MF A01.

Studies were made on the causes of observed leaks in mild steel tanks used to store liquid waste from nuclear fuel reprocessing at the Savannah River Plant. Leaks were observed in the walls of some primary vessels and in some cooling coils. The studies revealed that: wall leaks resulted from nitrate stress corrosion cracking caused by alkaline nitrate solution; and coil leaks resulted from pitting corrosion caused by diluted waste solutions during sludge removal. Stresses that caused wall cracking were residual stresses, primarily those produced during tank fabrication. Pitting of coils was caused by the concurrent dilution of nitrite in the waste supernate, and leaching of sulfate from the sludge. Results of these studies provided the bases for modifications in fabrication and operation of waste tanks. The modifications included: selection of more stress corrosion resistant steels for tank fabrication, heat treatment of newly fabricated tanks to relieve stresses, operation of tanks at temperatures above the nil ductility transition temperature of the steel to preclude brittle fast fracture, operation of tanks at temperatures below specified upper limits to reduce incidence of nitrate stress corrosion cracking, specification of limits on concentrations of nitrate, nitrite, and hydroxide ions in waste supernate to prevent stress corrosion cracking of walls, and specification of limits on nitrite ion concentration in sludge slurry to prevent pitting corrosion of cooling coils.

**21181** (ORNL/Sub—4415) **Evaluation of hydrologic isolation from evidence in mine openings in igneous and metamorphic rocks in the Maritime Provinces of Canada.** Martinez, J.D. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Office of Waste Isolation). Sep 1975. Contract W-7405-ENG-26. 58p. NTIS, MF A01.

Portions of document are illegible.

Conditions in the mines inspected ranged from very wet to very dry. The Heath Steele Mine certainly provided an example of severe leakage through either the country rock, the ore, or both. By way of contrast, the Brunswick Mine is very dry, particularly at the 2800 foot level. A note of caution is raised by this dissimilarity, inasmuch as the local geologic setting for both mines is very much alike. The Buchans Mine also provided evidence of dry conditions at the depth inspected (3215 ft). The Ming Mine at Baie Verte is also nearly dry with a decrease in water leakage with depth. It seems reasonable to tentatively conclude that mined openings in the rock types investigated (volcanics and sediments metamorphosed to a low or subgreen schist facies and intensely deformed) would provide hydraulic isolation at depths on the order of 2800-3200 feet below the surface or greater. It is disturbing to have found one mine that is very wet at shallow depths and to have received reports of some water problems in shaft construction. This report in conjunction with other more comprehensive studies should provide a point of departure for more detailed studies of the nature and causes of hydraulic isolation provided by igneous and metamorphic rocks. 27 figs.

**21182** (UCRL—13804) **Draft environmental impact statement. High-level waste repository site suitability criteria.** (Tera Corp., Berkeley, Calif. (USA)). 21 Jan 1978. Contract W-7405-ENG-48. 147p. Dep. NTIS, PC A07/MF A01.

The purpose of HLWRSSC is to present guidelines which will help in the development of safe waste management schemes. Current regulations require solidification of all high-level waste within 5 years of their generation and transfer to a Federal waste repository within 10 years. Development of the proposed HLWRSSC is part of the overall NRC program to close the "back end" of the commercial LWR fuel cycle. In this document, the need for the HLWRSSC is reviewed, and the national energy policy, the need for electrical energy, and the nuclear fuel cycle are discussed. Considerations for HLWRSSC are presented, including the nature of the repository, important site-related factors, and radiological risk assessment methodology. Radiological and nonradiological environment impacts associated with the HLWRSSC are defined. Alternatives to the criteria are presented, and the cost-benefit-risk evaluation is reviewed. (DLC)

**21183** (USGS-OFR—77-761) **Subsurface geology of a potential waste emplacement site, Salt Valley Anticline, Grand County, Utah.** Hite, R.J. (Geological Survey, Washington, D.C. (USA)). 1977. Contract EY-76-C-05-4339. 32p. Dep. NTIS, PC A03/MF A01.

The Salt Valley anticline, which is located about 32 km northeast of Moab, Utah, is perhaps one of the most favorable waste emplacement sites in the Paradox basin. The site, which includes about 7.8 $km^2$, is highly accessible and is adjacent to a railroad. The anticline is one of a series of northwest-trending salt antilcines lying along the northeast edge of the Paradox basin. These anticlines are cored by evaporites of the Paradox Member of the Hermosa Formation of Middle Pennsylvanian age. The central core of the Salt Valley anticline forms a ridgelike mass of evaporites that has an estimated amplitude of 3,600 m. The evaporite core consists of about 87 percent halite rock, which includes some potash deposits; the remainder is black shale, silty dolomite, and anhydrite. The latter three lithologies are referred to as "marker beds." Using geophysical logs from drill holes on the anticline, it is possible to demonstrate that the marker beds are complexly folded and faulted. Available

data concerning the geothermal gradient and heatflow at the site indicate that heat from emplaced wastes should be rapidly dissipated. Potentially exploitable resources of potash and petroleum are present at Salt Valley. Development of these resources may conflict with use of the site for waste emplacement.

**21184** (Y/OWI/SUB—77/16523/2) **Scoping report on various salt mines in the United States.** Jacoby, C.H. (Jacoby and Co., Dalton, Pa. (USA)). Jul 1977. Contract W-7405-ENG-26. 52p. Dep. NTIS, PC A04/MF A01.

One of the most important factors in isolating the demonstration waste storage site is an adequate number of shafts to insure proper ventilation. Proper ventilation will require that the air exhausted from the storage area pass directly to the upcast air shaft. Those mines reported by this scoping contract generally conform with the two shafts per mine requirement of MESA. Three of the mines reported on have more than two shafts. Several of the mines can have additional shafts drilled in time to meet ERDA's schedule. Rough drilling costs have been cited in the report. From an economic standpoint, it is probable that the larger the mine, the greater the economic impact with regard to any dislocation of production that may be required. In some cases, such as the Retsof Mine and the Cayuga Mine, multiple shafts eliminate the probability of dislocation. Those small tonnage mines such as the Kleer at Grand Saline, Texas; the Hockley Mine near Houston and the Lyons Mine of the American Salt Company might be leased or purchased in their entirety.

**21185** (Y/OWI/SUB—77/16535/2) **National Waste Terminal Storage Program: planning and control plan. Volume II. Plan description.** (Control Data Corp., Knoxville, Tenn. (USA)). May 1977. Contract W-7405-ENG-26. 46p. Dep. NTIS, PC A03/MF A01.

Objective of the NWTS program planning and control plan is to provide the information necessary for timely and effective OWI management decisions. Purpose is to describe the concepts and techniques that will be utilized by OWI to establish structured, completely planned and controlled technical, cost, and schedule NWTS baselines from which performance or progress can be accurately measured.

**21186** (Y/OWI/SUB—77/16535/4) **National Waste Terminal Storage Program: configuration management plan. Volume II. Plan description.** (Control Data Corp., Knoxville, Tenn. (USA)). May 1977. Contract W-7405-ENG-26. 32p. Dep. NTIS, PC A03/MF A01.

Purpose of the Configuration Management Plan is to provide the management discipline through which the integrity and continuity of program cost and schedule trade-off decisions which are made concerning the site selections and facilities performance, producibility, operability and supportability are recorded, communicated, and controlled by the Office of Waste Isolation.

**21187** (Y/OWI/SUB—77/16535/7) **National Waste Terminal Storage Program: critical element management concept. Volume I. Management summary.** (Control Data Corp., Knoxville, Tenn. (USA)). May 1977. Contract W-7405-ENG-26. 10p. Dep. NTIS, PC A02/MF A01.

CEM is oriented towards identifying, quantifying and curtailing probable impediments to a program originating from both the internal and external program environments. Critical elements are defined as events, trends or conditions that could generate potential uncertainties in the program. The critical elements are broken down into components against which management action is initiated.

**21188** (Y/OWI/SUB—77/16535/8) **National Waste Terminal Storage Program: critical element management concept. Volume II. Concept description.** (Control Data Corp., Knoxville, Tenn. (USA)). May 1977. Contract W-7405-ENG-26. 31p. Dep. NTIS, PC A03/MF A01.

The objective of the CEM Concept is to describe techniques for systematically identifying, evaluating, and influencing those technical, social, economic, political and institutional factors (i.e., events, trends and conditions) that are perceived as being probable uncertainties to the attainment of planned program objectives.

**21189** (Y/OWI/SUB—77/16537) **National waste terminal storage program.** (Saberian (A.) and Associates, Austin, Tex. (USA)). 1977. Contract W-7405-ENG-26. 40p. (CONF-770383—). Dep. NTIS, PC A03/MF A01.

From Review meeting on salt dissolution; Austin, TX, USA (29 Mar 1977).

A brief summary of the meeting is given. Two abstracts and three papers are included as appendices. Separate abstracts were prepared of these three papers. (DLC)

**21190** (Y/OWI/SUB—4091/6) **Borehole cement and rock properties studies: progress report, October 1, 1976—September 30, 1977.** Roy, D.M. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.). 30 Sep 1977. Contract W-7405-ENG-26. 118p. Dep. NTIS, PC A06/MF A01.

Research progress is reported in sections on properties of cements, permeability studies, cement-rock interactions, cement long range stability, waste-rock interactions, and properties of shale. Results suggest that present canister emplacement design is inadequate. Present data suggest that canisters should be placed to a depth at least as great as the width of the chamber opening. This means, with current geometry, burial of the top of the canister to 18 ft. depth. For certain materials, and with further study of the question, design requirements may prove even more stringent. Other aspects of the problem remain to be adequately considered; these aspects may be influential in affecting burial design criteria. These factors include general thermoelastic effects, fluid pressures, and effects of pre-existing discontinuities, as well as site-specific issues. (JRD)

**21191** (Y/OWI/SUB—4310/4) **Supplemental field and literature investigation of the upper cretaceous Austin Group (chalk) of Texas with regard to its potential for radioactive-waste isolation.** Gonzales, S. (Earth Resource Associates, Inc., Athens, Ga. (USA)). Jun 1977. Contract W-7405-ENG-26. 41p. Dep. NTIS, PC A03/MF A01.

Regional stratigraphy, local stratigraphy, structural geology, mineral resource development, and evaluation of repository potential are discussed. (LK)

**21192** **Summary of shallow land burial of radioactive wastes at commercial sites between 1962 and 1976, with projections.** Holcomb, W.F. *Nucl. Saf.;* **19**: No. 1, 50-59(1978).

The U.S. Environmental Protection Agency requested the six states having commercial shallow land burial facilities for other-than-high-level radioactive wastes to provide inventories of the types and quantities of wastes buried at these sites. Compilations and interpretations of the inventories are presented in tables and figures. Projections to the year 2000 are made and compared with other projections of the quantity of fuel-cycle and nonfuel-cycle wastes to be disposed of by shallow land burial. These projections are then compared with the assumed available capacity and operational life of the commercial sites. The results of this comparison indicate that the existing sites should have adequate burial capacity until the late 1990s.

**21193** **High-level and long-lived radioactive waste disposal.** Angino, E.E. (Univ. of Kansas, Lawrence). *Science;* **198**: No. 4320, 885-890(2 Dec 1977).

No uniform international approach for handling the problem of high-level radioactive waste disposal exists. All the while, the volume of these wastes continues to grow. The only viable solution to the disposal problem is considered to be a geologic one. Burial of these wastes in solid form for long periods of time in mined cavities in salt or Precambrian crystalline rock formations is technically possible. Several steps in the burial process have already been demonstrated in Germany. The problem becomes more serious as the number of countries committed to the use of nuclear energy grows. If one considers the problems of seismic stability and worldwide distribution of salt deposits, the overwhelming need for an international solution to the waste disposal problem seems obvious.

**21194** **Chemistry of nuclear waste disposal.** Henrich, E. *Nafta (Katowice, Pol.);* **25**: No. 5, 233-237(May 1977). (In German).

The physical-chemical fundamentals and the state of technology in the field of nuclear waste disposal are discussed in summary form. The historical development of reprocessing, the chemistry and technology of the purex process, the conditioning and final storage of radioactive waste, the decontamination of the waste gases and safety problems are individually dealt with.

**21195** (DOE-tr—49) **Experimental investigations on anhydrite. Report No. 2.** Mueller, W.H.; Briegel, U. 22 Mar 1977. Translation: source information not available. 85p. Dep. NTIS, PC A05/MF A01.

Results of investigations of Swiss anhydrite rock are presented. The investigations concerning the mechanical behavior of anhydrite show that its stability is heavily dependent on the grain size and the structure. Other stability-determining factors such as the mineralogical composition, porosity, and crystal defects reveal a less significant influence. It can generally be stated that the fine-grained anhydrite from the Wandflue and Riburg have a greater stability than the coarse-grained anhydrites from Bex and the Piora Trough. The prevailing deformation mechanism in this temperature range is cataclase. The x-ray diffractometrically investigated specimens from the horizontal borehole of the Val Canaria contain, except for two cases, predominantly anhydrite in addition to minimal quantities of dolomite, magnesite, phlogopite, talc, chlorite, and gypsum. The anhydrite content ranges between 52% and 95% whereby the average amounts to ca. 75%. Dolomite, magnesite, and phlogopite are most generally the secondary constituents. One of the exceptions comes from a joint healed by gypsum and the other from a 10-15 cm wide muscovite-paragonite lens. The values of the porosity all range under 1% except for one specimen (AVC 14, 1.32%).

**21196 Nuclear Regulatory Commission's Low-Level Waste Management Program.** Bell, M.J. (U.S. Nuclear Regulatory Commission, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 143-144(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21197 ERDA's role in low-level waste management.** Daly, G.H. (Energy Research and Development Administration, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 144-145(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21198 EPA activities in radioactive waste management.** Smith, D.S. (U.S. Environmental Protection Agency, Montgomery, AL). *Trans. Am. Nucl. Soc.;* **27**: 145(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21199 Goals and projects of U.S. Geological Survey for the study of solid low-level radioactive wastes.** Wood, W.W.; DeBuchananne, G.D. (U.S. Geological Survey, Denver). *Trans. Am. Nucl. Soc.;* **27**: 145-146(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21200 Overview of low-level radwaste management.** Garrett, P.M. (Atomic Industrial Forum, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 146-147(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

## ENVIRONMENTAL ASPECTS

*REFER ALSO TO CITATION(S) 21166, 21216, 22160, 22161, 22162, 22163, 22171, 22172, 22179, 22182, 22183, 22184, 22187, 22197, 22220, 22265*

**21201** (GJT—125) **Summary of the Phase II, Title I, engineering assessment of inactive uranium mill tailings, Gunnison Site, Gunnison, Colorado.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Nov 1977. Contract EY-76-C-13-1658. 56p. Dep. NTIS, PC A04/MF A01.
Ford, Bacon and Davis Utah Inc. has performed an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Gunnison, Colorado. The Phase II—Title I services include the preparation of topographic measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology, and the evaluation and costing of alternative corrective actions. Radon gas release from the 0.5 million tons of tailings at the Gunnison site constitutes the most significant environmental impact, although windblown tailings and external gamma radiation are also factors. The nine alternative actions presented range from millsite decontamination (Option I), to adding various depths of stabilization cover material (Options II and III), to removal of the tailings to long-term storage sites and decontamination of the present site (Options IV through IX). Cost estimates for the nine options range from $480,000 to $5,890,000. Reprocessing the tailings for uranium does not appear to be economically attractive at present.

**21202 Environmental surveillance for nuclear facilities.** Moeller, D.W.; Selby, J.M.; Waite, D.A.; Corley, J.P. *Nucl. Saf.;* **19**: No. 1, 66-79(1978).
One of the primary goals of environmental surveillance programs in the vicinity of nuclear facilities is to obtain information essential to assessing and controlling dose rates to the neighboring population. Experience has shown, however, that environmental radionuclide concentrations are frequently so low and so variable that dose estimates must be based primarily on in-plant and effluent measurements, coupled with suitable calculational techniques for extrapolating such data to the general environment. Although the number of pathways by which each of the released radionuclides may ultimately reach the population are numerous and complex, in most situations the primary contributors to the population dose will consist of no more than six radionuclides moving through three or four pathways. Current problems associated with environmental surveillance programs include (1) lack of a definition of de minimis dose levels for measurement or calculation; (2) deficiencies in quality assurance, data treatment, and source impact definition; (3) lack of periodic in-depth review and reevaluation of programmatic needs; and (4) lack of sufficient resources on the part of state and local agencies for providing an independent check on the data reported by nuclear facility operators.

**21203 Effluents from the LWR stowaway fuel cycle.** Kabele, T.J.; Heeb, C.M.; Schneider, K.J.; Kennedy, W.E.; Lewallen, M.A. (Battelle Northwest Labs., Richland, WA). *Trans. Am. Nucl. Soc.;* **27**: 127-128(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21204 ENFORM fuel cycle effluents model.** Heeb, C.M.; Lewallen, M.A.; Purcell, W.L. (Battelle Northwest Labs., Richland, WA). *Trans. Am. Nucl. Soc.;* **27**: 128-129(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21205 Environmental assessment methodology for the nuclear fuel cycle.** Brenchley, D.L.; ;Soldat, J.K.; McNeese, J.A.; Watson, E.C. (Battelle Northwest Labs., Richland, WA). *Trans. Am. Nucl. Soc.;* **27**: 129-130(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21206 Releases of radioactivity from uranium mills and radwaste effluent costs.** Witherspoon, J.P.; Sears, M.B.; Blanco, R.E. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 151-152(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**21207 Radiological criteria for the phase II inactive mill tailings program.** Rogers, V.C. (Ford, Bacon and Davis Utah, Salt Lake City). *Trans. Am. Nucl. Soc.;* **27**: 153-154(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

## HEALTH AND SAFETY

*REFER ALSO TO CITATION(S) 21144, 22122, 22195, 22255, 22256, 22266, 22267*

**21208** (DOE/EV—0005-1) **Formerly utilized MED/AEC sites remedial action program. Radiological survey of the Middlesex Sampling Plant, Middlesex, New Jersey. Final report.** (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 113p. Dep. NTIS, PC A06/MF A01.
The results of a radiological survey of the former Middlesex Sampling Plant, Middlesex, New Jersey, are presented in this report. The surveyed property served as a uranium ore sampling plant during the 1940's and early 1950's. It was released for unrestricted use in 1968 following a radiological survey by the Atomic Energy Commission and is now a reserve training center for the U.S. Marine Sixth Motor Transport Battalion. The present survey was undertaken to determine whether the existing radiological status of the property is consistent with current health guidelines and radiation protection practices. The radiological survey included measurement of residual alpha and beta-gamma contamination levels, radon and radon daughter concentrations in buildings, external gamma radiation levels on the site and on adjacent property, and radium concentrations in soil on the site and on adjacent property. Surface contamination levels exceeded U.S. Nuclear Regulatory Commission (NRC) guidelines and $^{222}$Rn concentration levels exceeded the non-occupational maximum permissible concentration MPC/sub a/ of 3 pCi/liter in some structures. These results indicate the possible need for extensive radon and radon daughter measurements in structures both onsite and offsite over periods as suggested by the U.S. Surgeon General (as adopted in 10 CFR 712).

**21209** (HRP—0006691) **Respiratory disease mortality among uranium miners as related to height, radiation, smoking, and latent period.** Archer, V.E.; Gillam, J.D.; James, L.A. (National Inst. for

Occupational Safety and Health, Salt Lake City, Utah (USA)). Nov 1975. 30p.

A prospective mortality study using a life table method was done on 3366 white underground uranium miners, and 1231 surface workers. Observed deaths were found to exceed those expected from respiratory cancer, pneumoconiosis and related diseases, and accidents related to work. Exposure - response relationships with radiation varied with cigarette smoking and with height of workers. Of four factors involved in both malignant and nonmalignant respiratory diseases (height, free silica, cigarette smoking and alpha radiation), radiation was considered to be most important.

**21210** (HRP—0006798) **Inhalation of dust contaminated with plutonium: Possible health effects. Health considerations of proposed residential development of land contaminated with plutonium in the Denver area.** Johnson, C.J. (Colorado Univ., Denver (USA). School of Medicine). Nov 1975. 25p.

The possible health effects of inhaling dust contaminated with plutonium were investigated in Jefferson County, Colorado. A plan fabricating radioactive metals and performing chemical processing in the county began operation in 1953. Interest in evaluating the extent of offsite plutonium contamination was the result of a major fire in May 1969. A thorough evaluation of offsite contamination was made by the Health and Safety Laboratory of the Atomic Energy Commission in 1970. Soil samples were collected to a depth of 20 centimeters at 33 sites extending as far as 40 miles from the plant. The contamination pattern was found to extend eastward from the plant, with scarcely any westward component, and the eastward direction was incompatible with the wind direction on the day of the 1969 fire. Leaking barrels of plutonium millings in oil were confirmed as the most important source of contamination. Experimental and clinical studies on the potential health effects of plutonium exposure are cited. It is concluded that, with sufficiently detailed statistical studies, significant effects from airborne plutonium will be noted. Such effects would be noticed as a slight but significant excess in the incidence of neoplasms of the lungs, lymph nodes, and liver and bone and a slight increase in the frequency of congenital defects and childhood leukemia. A list of references is included, along with data on plutonium soil concentrations and health effects.

**21211** (Y/OWI/SUB—77/42509) **As low as is reasonably achievable (ALARA) studies relative to the NWTS program.** Abrams, L.A.; Schlegel, R.L.; Sullivan, R.P. (NUS Corp., Rockville, Md. (USA)). Oct 1977. Contract W-7405-ENG-26. 150p. Dep. NTIS, PC A07/MF A01.

The history of development of the as-low-as-is-reasonably achievable (ALARA) concept and ALARA criteria for radiation exposures as applied to both off-site (environmental) and on-site (occupational) exposures at nuclear power plants are reviewed. The current status of activities within the various federal agencies directed toward developing ALARA criteria for other areas of the nuclear fuel cycle is presented. Based on the historical development, the present activities, and on discussions with numerous people involved in this area, the future development of ALARA criteria and implications for the National Waste Terminal Storage (NWTS) Program is forecast. Environmental ALARA criteria which relate to minimizing radiation to the surrounding populaltion are discussed along with current occupational ALARA criteria and quidelines for risk-benefit assessments that are under development and recommendations to assure that evolving ALARA concepts are periodically brought up to date and that such concepts be made available to those subcontractors who have responsibility for design and operation of a repository. An annotated bibliography of some 83 sources giving information on ALARA criteria and its application is included. (JRD)

**21212 Explosion and fire during conversion of liquid uranyl nitrate to solid uranium oxide.** Gray, L.W. *Nucl. Saf.;* **19**: No. 1, 91-99(1978).

During the conversion of molten uranyl nitrate to solid uranium oxide at the Savannah River Plant, a rapid chemical reaction occurred in a denitrator and expelled the contents, including combustible gases, into the process room. The gases ignited and caused a gas-phase explosion and fire. An excessive amount of organic material (approximately 120 liters of tributyl phosphate in the form of uranyl nitrate adduct) had been unintentionally transferred, along with normal process material, through two evaporators to the denitrator. During heating of the denitrator contents, the organic material decomposed rapidly between 170 and 210°C, emitting combustible and noncombustible gases that ejected the denitrator contents into the denitrator room. The gas collected at the ceiling in the room and ignited with a low explosive force. Two employees sustained minor injuries, and there was about $230,000 damage to the building and equipment.

**21213 Containment and removal of radioactive spills by depositing a crosslinked ion exchange composition in a dry form over region of spill.** Calmon, C. US Patent 4,056,112. 1 Nov 1977. Filed date 2 May 1974. 8p.

A new use for ion exchange compositions and a new method for utilizing such compositions in containing and removing spills of radioactive materials. The ion exchange compositions when used with liquid spills are arranged to have a cross-linking which, when they are deposited over the spill, permits them to absorb the liquid spill simultaneously with the occurrence of an exchange of the radioactive ions with the ions of the ion exchange compositions. A dry spill of radioactive material can be contained and removed by using a dampened ion exchange composition which is deposited over the spill. The wet or dry spills can then be readily and safely removed for appropriate disposal.

**21214 Nuclear safety problems and their consequences on the materials used.** Servant, J. *Mater. Tech.;* **6**: 295-303(Jun 1977). (In French, English).

From 2. Colloquium on special steels and nuclear energy; Paris, France (14 - 15 Dec 1976).

Materials play an important part in nuclear safety. Various tight and strong barriers are placed in succession between radioactivity sources and the public: nuclear fuel claddings; vessels of the circuits of coolant; containments. These barriers can be made of homogeneous or composite metal or non-metal materials. The materials adaptation is evaluated in terms of possible damages. They must be carrefully analyzed, checked and monitored. Materials play an important part in workers protection, either directly (shielding) or indirectly (maintenance and repairs in radioareas). Then, nuclear safety extends to public protection, not only against the effects of possible accidents, but also against the effects of radioactive effluent releases during normal operation.

**21215 Basis for subcritical limits in proposed criticality safety standard for mixed oxides.** Clayton, E.D.; Clark, H.K.; Magnuson, D.W.; Chalmers, J.H.; Walker, G.; Ketzlach, N.; Kiyose, R.; Brown, C.L.; Smith, D.R.; Artigas, R. (Battelle Northwest Lab, Richland, Wash). *Nucl. Technol.;* **35**: No. 1, 97-111(1977).

Subcommittee 8 of the Standards Committee of the American Nuclear Society has proposed a standard providing subcritical limits for operations with mixed oxides of plutonium and uranium. The subcritical limit is the limiting value assigned to a controlled parameter that results in a system known to be subcritical, provided the limiting value of no other controlled parameter of the system is violated. The proposed standard includes subcritical limits for mixed oxides containing up to 30 wt% plutonium in Pu + U. A review is made of available experimental data and validations undertaken that serve as the basis of the limits, and the assertion that they are, indeed, subcritical as given.

**21216 Uranium mine radon control research.** Bates, R.C.; Franklin, J.C. (U.S. Dept. of the Interior, Spokane). *Trans. Am. Nucl. Soc.;* **27**: 150-151(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21217 Penchant for protectionism.** Shreve, J.D. Jr. (Kerr-McGee Corp., Oklahoma City). *Trans. Am. Nucl. Soc.;* **27**: 152-153(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## REGULATIONS

### ACCOUNTABILITY AND SAFEGUARDS

**21218** (ERDA—77-34) **Joint ERDA-NRC task force on safeguards. Final report, July 12, 1976.** (Nuclear Regulatory Commission, Washington, D.C. (USA); Energy Research and Development Administration, Washington, D.C. (USA)). Nov 1976. 77p. (NUREG—0095). Dep. NTIS, PC A05/MF A01.

A joint ERDA-NRC task force was created to develop a proposed action plan for improving the control and protection of nuclear materials at NRC licensed fuel cycle facilities possessing significant amounts of highly enriched uranium and plutonium. This report briefly summarizes the task force findings and proposed plan of action. The task force addressed the current status and future direction of physical security safeguards at NRC licensed fuel cycle facilities now in possession of significant amounts of strategic special nuclear materials (SSNM). The focus of the task force was on near-term, site specific actions that would provide confident control and protection against thefts or diversions of SSNM. (LK)

**21219** (PB—269346) **Computerized site security monitor and response system.** Moore, R.T.; Carpenter, R.J.; Koeing, A.L. (National Bureau of Standards, Washington, D.C. (USA). Computer Systems

Engineering Div.). 1 Jun 1977. 46p. (NBSIR—77-1262). NTIS PC A03/MF A01.

The Computerized Site Security Monitor and Response System (CSSMRS) was conceived as an integrated, state-of-the-art, computer-based system to enhance and improve the overall physical security of storage sites for special weapons or materials. This report is divided into three sections. Section 1 contains an overview summary of the findings or study results for each of the eight specific phase 1 tasks. These are set forth in varying degrees of detail as appropriate to both the nature of the task and the results. Section 2 is a description of the CSSMRS in its current (and incomplete) state of evolution. Here many of the attributes, capabilities, and features developed during the course of Phase I work are set forth. Some of the alternatives are identified as are areas where additional work will be necessary to reach clearly identifiable and attainable objectives necessary to complete the system definition. In section 3, a proposed phase 2 work plan is presented.

**21220** (PB—270656) **Calorimetric assay of plutonium. Technical report.** Rodenburg, W.W. (Mound Lab., Miamisburg, Ohio (USA)). May 1977. Contract ERDA-EY-76-C-04-0053. 19p. NTIS PC A02/MF A01.

This report describes procedures for applying calorimetry for the control and accounting of plutonium. These procedures will be useful in establishing a measurement program to fulfill the regulatory requirements.

**21221** (SAND—77-0043) **Insider safeguards effectiveness model (ISEM). User's guide.** Boozer, D.D.; Engi, D. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0893. 90p. MF A01.

Portions of document are illegible.

A comprehensive presentation of the ISEM computer program is provided. ISEM was designed to evaluate the effectiveness of a fixed-site facility safeguards system in coping with the theft, sabotage, or dispersal of radiological material by a single person who has authorized access to the facility. This insider may be aided by a group of insiders who covertly degrade sensor systems. Each ISEM run evaluates safeguards system performance for a particular scenario specified by the user. The dispatching of guards following alarms and their interaction with the insider are explicitly treated by the model.

**21222** (UCRL—13733-5) **Extensions of Kalman recursive estimation theory to retrospective updating and interpolation with applications to instrument calibration.** Glassey, C.R.; Choy, Y.C. (California Univ., Berkeley (USA). Operations Research Center). Sep 1977. Contract W-7405-ENG-48. 41p. (ORC—77-25). Dep. NTIS, PC A03/MF A01.

The problem of estimation of a physical quantity from a set of measurements is considered. We extend Kalman recursive estimation procedure in two ways. First, we explore how to use the latest observation to retrospectively update estimates of past system states. Second, we show how to apply the retrospective update idea to get interpolation estimates between the epochs of observations. We also show application of these ideas for instrument calibration in nuclear accountability systems.

**21223** **Recent developments and accomplishments in safeguards education and standards for the control of nuclear materials.** Cardwell, R.G. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 106(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21224** **Research required for international safeguards.** Kouts, H. (Brookhaven National Lab., Upton, NY). *Trans. Am. Nucl. Soc.;* **27**: 176(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21225** **Physical protection safeguards for nuclear materials and facilities.** Jones, O.E. (Sandia Labs., Albuquerque, NM). *Trans. Am. Nucl. Soc.;* **27**: 176-177(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21226** **Performance of safeguards technology-hardware, people, systems.** Kull, L.A.; Glancy, J.E.; Harris, L., Jr. (Science Applications, Inc., Albuquerque, NM). *Trans. Am. Nucl. Soc.;* **27**: 177-178(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21227** **Decision analysis in safeguarding special nuclear material.** Shipley, J.P. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 178-179(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21228** **Safetguards planning in a plant design process.** Heinrich, L.A. (Savannah River Lab., Aiken, SC). *Trans. Am. Nucl. Soc.;* **27**: 179-180(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21229** **Nondestructive analysis methods for the measurement of special nuclear materials.** Menlove, H.O. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 181(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21230** **Thermal-neutron coincidence counting of large plutonium samples.** Ensslin, N.; Evans, M.L.; Menlove, H.O.; Sapir, J.; Swansen, J.E. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 182-183(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21231** **Automated approach to nuclear facility safeguards effectiveness evaluation.** Grady, L.M. (Sandia Labs., Albuquerque, NM). *Trans. Am. Nucl. Soc.;* **27**: 184-185(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21232** **Controllable unit approach to material control.** Seabaugh, P.W.; Rogers, D.R.; Fushimi, F.C.; Woltermann, H.A.; Ciramella, A.F. (Mound Lab., Miamisburg, OH). *Trans. Am. Nucl. Soc.;* **27**: 185-187(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21233** **Denatured fuel cycles for safeguards control.** Pigford, T.H.; Yang, C.S.; Maeda, M. (Univ. of California, Berkeley). *Trans. Am. Nucl. Soc.;* **27**: 187-189(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21234** **Reduced variance multiplication meter for plutonium sample verification and assay applications.** Dowdy, E.J.; Henry, C.N.; Millegan, D.R. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 189-190(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21235** **Autoradiographic techniques for rapid inventory of reactor fuel.** Brumbach, S.B.; Perry, R.B. (Argonne National Lab., IL). *Trans. Am. Nucl. Soc.;* **27**: 190-191(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

# FUSION FUELS

## PROCESSING

### FABRICATION AND TESTING

**21236** (UCRL—79442) **Fabrication of cryogenic laser fusion targets.** Woerner, R.L.; Hendricks, C.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Sep 1977. Contract W-7405-ENG-48. 6p. (CONF-780202—7). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

Two novel techniques which produce a uniform frozen layer of deuterium-tritium on the inside surface of a glass microsphere are presented.

**21237** (UCRL—79772) **Problems with rho R measurements: what are the ways out.** Pan, Y.L.; Larsen, J.T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1977. Contract W-7405-ENG-48. 44p. (CONF-771136—8). Dep. NTIS, PC A03/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

An important scaling parameter or figure of merit in inertially-confined fusion is the maximum fuel rho R achieved by the target—rho is the density, and R the radius of the fuel. Every technique used, thus far, in laser-initiated-fusion-microexplosion experiments to obtain this data had major deficiencies. We examine critically the merits of the various possible methods of measuring fuel rho R and their ranges of applicability.

## BY-PRODUCTS

*REFER ALSO TO CITATION(S) 21243, 21248*

# ISOTOPE AND RADIATION SOURCE TECHNOLOGY

## PHYSICAL ISOTOPE SEPARATION

*REFER ALSO TO CITATION(S) 21143*

## RADIATION SOURCES

**21238** (PB—269341) **Exposure spectra from NBS vertical-beam $^{60}$Co gamma-ray source. Final report.** Ehrlich, M.; Soares, C. (National Bureau of Standards, Washington, D.C. (USA). Inst. for Basic Standards). Nov 1976. 12p. (NBSIR—76-1117). NTIS PC A02/MF A01.

Exposure spectra at a distance of 1 meter from the NBS vertical-beam $^{60}$Co gamma-ray source are presented in tabular form for field sizes of practical interest. Also tabulated are contributions to exposure arising from source housing and collimator, as well as from the source proper.

### DESIGN AND FABRICATION

**21239** **Starting material radiation source for Moessbauer investigations of tellurium compounds.** Alexandrov, A.J.; Grushko, J.S.; Makarov, E.F.; Mishin, K.Y.; Baltrunas, D.A.J. US Patent 4,059,769. 22 Nov 1977. Filed date 6 Jul 1976. 4p.

A method is described of preparing a radiation source for Mossbauer investigations of tellurium compounds manufactured on the basis of 5 MgO . $Te^{124}O_3$. 5 MgO . $Te^{124}O_3$ is irradiated in a reactor by means of thermal neutrons, followed by annealing at a temperature ranging from 600° to 1,100° C for a period of from 5 to 10 hours.

### OTHER INDUSTRIAL USES

*REFER ALSO TO CITATION(S) 22257*

**21240** (SAND—77-1411) **Recent developments in the Sandia Laboratories' sewage sludge irradiation program.** Sivinski, H.D.; Brandon, J.R.; Morris, M.E.; Neuhauser, K.S.; Ward, R.L.; McCaslin, B.; Smith, G.S. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0789. 72p. Dep. NTIS, PC A04/MF A01.

Pathogen reduction studies have shown that a 1 Mrad treatment (or less at elevated temperatures) is very effective in eliminating pathogenic bacteria and viable parasite ova in liquid sludges. Heat is effective in reducing levels not only of pathogenic bacteria and Ascaris ova, but viruses as well. Ammonia has been shown to be virucidal to poliovirus and several other enteric viruses. Sludge processing costs are seen to be marginally competitive with heat treatment for liquid sludges and relatively economical for composted or dried sludges. Physical/chemical effects studies have shown that the effects of irradiation of sludges on dewatering properties are not significant when compared to polymers, nor is the combined effect synergistic. Dried, irradiated undigested sludge has been shown to be of significant nutritional value when used as a feed supplement for sheep and cattle, as well as in agronomic uses. No significant harmful effects have been demonstrated in the feeding program thus far. Product enhancement studies are currently under way, including schemes for removing nitrogen from effluent streams for addition as ammonium salts to sludges.

## ISOTOPIC POWER SUPPLIES

*REFER ALSO TO CITATION(S) 22128*

**21241** (ORNL/TM—5908) **Assessment of fibrous insulation materials for the selenide isotope generator system.** Wei, G.C; Tennery, V.J. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 31p. Dep. NTIS, PC A03/MF A01.

Fibrous insulations for use in the converter and the heat source of the radioisotope-powered, selenide element, thermoelectric generator (selenide isotope generator) are assessed. The most recent system design and material selection basis is presented. Several fibrous insulation materials which have the potential for use as load-bearing or nonload-bearing thermal insulations are reviewed, and thermophysical properties supplied by manufacturers or published in the literature are presented. Potential problems with the application of fibrous insulations in the selenide isotope generator are as follows: compatibility with graphite, the thermoelectric elements, and the isolation hot frame; devitrification, grain growth, and sintering with an accompanying degradation of insulation quality; impurity diffusion from the insulation to adjoining structures; outgassing and storage of fibrous materials. Areas in which thermophysical data or quantitative information on the insulation and structural stability is lacking are identified.

# HYDROGEN

*REFER ALSO TO CITATION(S) 21388*

**21242** (NP—22816) **Hydrogen Energy Task Force report of the workshop on hydrogen energy, July 13—14, 1977.** (Department of Science and Tech., New Delhi (India)). 1977. 29p. TIC.

A Task Force was formed to prepare a viable action plan for development of hydrogen energy as best suited to the needs and conditions of India. Results are given from working groups on: production of hydrogen; storage, transmission, and utilization of hydrogen; and power systems, transduction, and technoeconomic aspects. The following production processes were considered: coal gasification, water electrolysis, thermochemical reaction cycles, photolysis and photoassisted electrolysis utilizing solar energy, photobiosynthetic methods, and microbiological methods. Storage systems considered are hydride and cryogenic systems. (LK)

## PRODUCTION

*REFER ALSO TO CITATION(S) 20984*

**21243** (CONF-770593—) **Fusion energy applied to synthetic fuel production: a report to the DOE Division of Magnetic Fusion Energy based on a preliminary study by an ad-hoc advisory group.** Booth, L.A. (Los Alamos Scientific Lab., N.Mex. (USA)). Oct 1977. Contract W-7405-ENG-36. 125p. Dep. NTIS, PC A06/MF A01.

From Conference on fusion energy applied to synthetic fuel production; Germantown, MD, USA (9 May 1977).

The general conclusion is that the potential for utilization of fusion energy for synthetic fuel production is favorable. Three basic methods of hydrogen production are identified: high-temperature electrolysis, thermochemical cycles, and direct radiolysis. Combinations of these and their use as in combined cycles for electric power generation are considered.

**21244** **Production of a hydrogen-rich gas from a CO-containing fuel gas.** Gorin, E. (to Continental Oil Co.). US Patent 4,067,958. 10 Jan 1978. Filed date 10 Mar 1976. 6p.

In a process for the production of hydrogen-rich gas from a fuel gas containing carbon monoxide and other components, the fuel gas is contacted in a formate synthesis zone with an aqueous solution containing sodium or potassium carbonate and/or bicarbonate under conditions effective to produce an effluent aqueous solution of the corresponding formate and an effluent gas containing the other components of the fuel gas. The aqueous formate solution is thereafter subjected to catalytic decomposition in a formate decomposition zone under conditions effective to produce a hydrogen-rich gas

and an aqueous solution which consists essentially of carbonate and/or bicarbonate solution.

## ELECTROLYSIS

*REFER ALSO TO CITATION(S) 21312, 21314, 21315*

**21245 Photo-electrolytic production of hydrogen.** Meyerand, R.G. Jr.; Krascella, N.L.; McMahon, D.G. (to United Technologies Corp.). US Patent 4,069,120. 17 Jan 1978. Filed date 21 Sep 1976. 6p.

Hydrogen and oxygen are produced from water in a process involving the photodissociation of molecular bromine with radiant energy at wavelengths within the visible light region and a subsequent electrolytic dissociation of hydrogen halides.

**21246 Nuclear reactors and hydrogen production.** Worley, N.G. (Babcock and Wilcox (OPS.) Ltd). *Gas World Gas J.;* **182**: No. 4706, 507-508,510(Sep 1977).

With nuclear power plants there is an economic incentive to keep the station at power even when the electricity load is not there and it is this "off peak" operation which is considered in some detail in this paper with the main usage for this "off peak" energy hydrogen generation by electrolysis of water. The suitability and the use of various types of nuclear reactors to generate hydrogen by splitting water are examined. Processes and costs involved in the generation of hydrogen from nuclear sources are also briefly considered.

**21247 Water splitting for the production of non-polluting energy carriers.** Schulten, R. *ISU Mitt.;* **6**: 120-125(1977). (In German).

Three different energy transfer systems are being developed at present for using nuclear energy on the non-electric market: 1) The direct supply of the vicinity of a nuclear reactor with relatively low-temperature heat from the electricity-heat coupling; 2) The long-distance transfer of process heat in chemically bonded form, i.e. either (2a) in closed circuit as chemical latent energy of a hydrogen-carbon monoxide mixture from the steam reformation of methane, or (2b) as pure hydrogen yielded by splitting water by means of chemical cycle processes or hybrid methods. The high-temperature nuclear reactor is the only one suitable as heat source of such transfer systems for nuclear, non-electric energy. A chemical cycle process based on methanol and sulfuric acid as well as a 2-step hybrid process based on sulfuric acid are briefly explained. The hybrid method involves an electrochemical process step.

## THERMOCHEMICAL PROCESSES

*REFER ALSO TO CITATION(S) 21247, 22685*

**21248** (UCID—17590) **Proposal to utilize fusion reactor energy sources for chemical process applications.** Krikorian, O.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Sep 1977. Contract W-7405-ENG-48. 10p. Dep. NTIS, PC A02/MF A01.

We propose to study the utilization of high-temperature (approximately 2000-2500K) process heat from fusion reactors for large-scale chemical process applications. Of particular interest is the decomposition reaction, $CO_2 \rightarrow CO + \frac{1}{2}O_2$, which at 2500K should yield approximately 60 percent conversion to CO if $O_2$ is partially removed through an oxide membrane. Hydrogen can be derived from CO at lower temperatures by reacting CO with steam, and C can also be derived from CO by a disproportionation into C and $CO_2$ at approximately 1000K. These chemicals, CO, $H_2$, and C, form the basis for a multitude of non-electrical energy applications in the areas of transportation, industrial processes, and residential and commercial uses. In addition to the $CO_2$ decomposition process, we propose to explore a variety of ideas and evaluate them for scientific and economic merit. A follow-on research and development program will be proposed if the ideas prove promising.

**21249 Study of thermochemical hydrogen preparation. II. Electrochemical hybrid cycle using sulfur-iodine system.** Dokiya, M.; Fukuda, K.; Kameyama, T.; Kotera, Y. (National Chemical Lab. for Industry, Tokyo (Japan)); Asakura, S. *Denki Kagaku;* **45**: No. 3, 139-143(Mar 1977).

Thermochemical water splitting processes by use of sulfur compounds are presented. These processes are partly based on the thermal decomposition of sulfuric acid for the step evolving oxygen. Three hydrogen evolving steps were investigated; (1) C//$SO_2$,$H_2SO_4$sub(aq), $H_2$//Pt, electrolysis (2) C//$SP_2$, $H_2SO_4$sub(aq)/$I_2$, HIsub(aq)/Pt, electrolysis (3) C//$SO_2$, $H_2SO_4$sub(aq)/$I_2$, HIsub(aq)//Pt, electrolysis without external electric power. Activated charcoal was found to be favorable material for the anodic reaction. In the case (1), the cycle is completed with two reaction steps but still it needs some electric power. In the cases (2) and (3), a cation exchange membrane is used and an additional step ($2HI \rightarrow H_2+I_2$) is necessary to produce hydrogen. The electric power required can be reduced compared with the case (1), and especially in the case (3), no electric power is required. On the basis of the present study, some future problems are proposed.

**21250 Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid.** Dokiya, M.; Kameyama, T.; Fukuda, K.; Kotera, Y. (National Chemical Lab. for Industry, Tokyo). *Bull. Chem. Soc. Jpn.;* **50**: No. 10, 2657-2660(1977).

The thermal decomposition of sulfuric acid is used as a step in the oxygen evolution in some thermochemical water-splitting cycles. The catalytic activity of metal oxides was studied in an attempt to find some suitable catalysts for sulfuric acid decomposition. The catalytic activity of $SiO_2$, $Al^3O_3$, ZnO, CuO, NiO, CoO, $Fe_2O_3$, MnO, $Cr_2O_3$, $V_2O_5$, $TiO_2$ was measured at high temperatures (800 to 870°C) and at atmospheric pressure. Iron(III) oxide was found to have the highest activity as a catalyst. Low catalytic activity was observed from the oxides ($Al_2O_3$, ZnO, NiO, CoO, MnO) which change to their sulfates under the present reaction conditions. Since the reaction conditions were very severe (more than 800°C and in the presence of steam), a rapid decrease in both the specific surface area and the catalytic activity was observed. In order to avoid these disadvantages and in order to prepare practically useful catalysts, iron(III) oxide was pelletized and sintered (1000°C, 6 h). Upon this procedure, this catalyst showed an almost constant activity for 120 hours' reaction.

## BIOSYNTHESIS AND PHOTOCHEMICAL PROCESSES

*REFER ALSO TO CITATION(S) 21312, 21313*

**21251 Continuous hydrogen production by immobilized whole cells of Clostridium butyricum.** Isao, K.; Matsunaga, T.; Tsuru, S.; Suzuki, S. (Tokyo Inst. of Tech.). *Biochim. Biophys. Acta;* **444**: No. 2, 338-343(1976).

C. butyricum IFO 3847 was immobilized in polyacrylamide gel. Increase of the polymer concentration decreased $H_2$ evolution from glucose by whole cells. The immobilized cells continuously evolved $H_2$ from glucose under aerobic conditions. The pH stability of $H_2$ production increased with immobilization, and the optimum temperature was 37°C. No difference in the amount of evolved $H_2$ was observed after storage for 1 month at 5°C. ($H_2$ production by microorganisms may serve as a clean fuel resource.)

## COAL GASIFICATION

*REFER ALSO TO CITATION(S) 20855*

## STEAM-IRON PROCESS

**21252** (FE—1518-46) **Development of the steam—iron system for production of hydrogen for the HYGAS process. Project 8920 final status report, May 1, 1973—June 30, 1976.** (Institute of Gas Technology, Chicago, Ill. (USA)). Oct 1977. Contract EY-76-C-01-1518. 296p. Dep. NTIS, PC A13/MF A01.

The status of the following eight major tasks is reported: reducing-gas-generation testing to establish operating conditions for the design of the producer reactor; process design and construction; shakedown operation of the pilot facility; fluidized-bed testing to obtain data for the design of the fluidized iron-ore beds, lift lines, and seal legs in the steam-iron reactor; slurry-feed testing to obtain data for design of the char-feed system; small-scale kinetic testing to evaluate the use of other iron compounds in the steam-iron process; char evaluation testing to determine preferred operating conditions for different chars to produce reducing gas for the steam-iron reactor; and computerized analysis and evaluation of plant design and operating data. (LK)

**21253** (FE—2435-19) **Development of the steam-iron process for hydrogen production. Project 9010 monthly status report, September 1—30, 1977.** (Institute of Gas Technology, Chicago, Ill. (USA)). Nov 1977. Contract EX-76-C-01-2435. 35p. Dep. NTIS, PC A03/MF A01.

In Task 1 (Reactor System Start-Up), smooth iron ore circulation was achieved for 133 hr in Test 10. Circulation rates as high as 70 tons/hr were obtained at 250 psig and 600°F. In Task 2 (Reactor Variables Study), bed temperatures were raised to 1650°F, and char feed was maintained for 107 hr. A reducing gas containing 25% CO + $H_2$ was produced. In Task 5 (Char Evaluation), two tests were made with western Kentucky bituminous char. The results of one of the tests showed that, when gasifying this char at 1870°F, sintering occurred when the fluidization velocity was reduced to 0.54 ft/s. In the other test, we gasified char at 1975°F with a fluidization velocity of 0.81 ft/s and achieved ash sintering by allowing the bed ash content to rise gradually by discharging char at the lowest possible rate while feeding char at a rate sufficient only to maintain the bed level. In Task 6 (Attrition Studies) eight tests were made with Husky lignite char (-80 + 100 U.S.S.) to determine the effects of inlet velocity and solids loading on the attrition characteristics of this char in the cyclone. In Task 7 (Lift-Line Studies), four tests determined the effects of lift-gas velocities of 30 and 34 ft/s on the operational characteristics of the transition zone. Four tests were

conducted to determine the choking velocities of siderite at solids mass velocities of 48, 77, 91, and 124 lb/sq ft-s.

## STORAGE

### CHEMISORPTION

**21254 Low-temperature absorption equilibrium and chemisorption in the $LaNi_5$(activated)/$H_2$ system.** Tanaka, S.; Clewley, J.D.; Flanagan, T.B. (Univ. of Vermont, Burlington). *J. Catal.;* **51**: No. 1, 9-17(Jan 1978).

Absorption isotherms for activated $LaNi_5/H_2$ have been determined in detail at 273 and 195°K. The variation of the two-phase plateau pressure with temperature has been measured from 174 to 273°K and extrapolates well with higher temperature data determined elsewhere; these data yield ΔH/sub α/beta/ = -15.0 kJ/mol of H. Hysteresis loops have been examined in the two-phase coexistence region. Excess hydrogen sorption has been determined as a function of the equilibrium hydrogen pressures by differences between sorption by activated and unactivated (low surface area) samples. The enthalpy for the excess sorption has been found to be approximately -30 kJ/mol of H and becomes less exothermic with extent of sorption. The amounts of the excess sorbed hydrogen are larger than anticipated from the measured surface area (BET, krypton, 77.4°K) in order for excess sorption to correspond to chemisorption; nonetheless, arguments are presented to suggest this correspondence.

**21255 Metal hydride storage for mobile and stationary applications.** Hoffman, K.C.; Reilly, J.J.; Salzano, F.J.; Waide, C.H.; Wiswall, R.H.; Winsche, W.E. Warrendale, PA; Society of Automotive Engineers (1976). 15p. (CONF-760678—29).

From Meeting of the Society of Automotive Engineers on combined fuels and powerplant; St. Louis, MO, USA (8 Jun 1976).

Metal hydrides offer the possibility of a convenient and safe method for the storage of hydrogen. These compounds provide for compact storage in a form that is equal to or better than cryogenic liquid hydrogen on a volume basis. Considerable research has gone into the study of hydrides derived from rare earth, iron-titanium, and magnesium alloys. The formation of these compounds is reversible and the chemistry of relevant hydrides has been discussed. Heat must be provided to decompose these compounds and release the hydrogen, while heat is liberated when the compounds are formed and must be removed to allow the hydriding reactions to proceed to completion. The iron-titanium and magnesium alloys are especially promising hydride storage media, the former in stationary applications, or where weight is not a limiting consideration, and the latter for mobile applications. Each of these materials has unique pressure-temperature characteristics and reaction kinetics which must be considered in the design of a hydrogen storage system. These special characteristics are discussed for particular applications. The results of recent work on hydrogen storage development and the engineering design of storage systems are reviewed.

## PROPERTIES

*REFER ALSO TO CITATION(S) 21954*

# OTHER SYNTHETIC AND NATURAL FUELS

*REFER ALSO TO CITATION(S) 21302*

## HYDROCARBON FUELS

*REFER ALSO TO CITATION(S) 21303, 21839*

## PROPERTIES

*REFER ALSO TO CITATION(S) 21044*

**21256** (CONF-770375—, pp 42-44) **Dew-point loci for methane—toluene system.** Hwang, S.C.; Kobayashi, R. (William Marsh Rice Univ., Houston, TX). 1977.

From 56. annual convention of the Gas Processors Association; Dallas, TX, USA (21 Mar 1977).

In Proceedings of the fifty-sixth annual convention of the Gas Processors Association.

The elution technique has been used to study the vapor phase composition for the methane-toluene system at three temperatures, 40, 20, and 0°F, from 50 up to 2,500 psia. No lower temperatures could be examined due to experimental limitations.

## PREPARATION

### CHEMICAL SYNTHESIS

*REFER ALSO TO CITATION(S) 20855, 20858, 20869, 20870*

**21257** (FE—2276-6) **Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October—December 1976.** Brennan, J.A. (Mobil Research and Development Corp., Paulsboro, N.J. (USA); Mobil Research and Development Corp., Princeton, N.J. (USA)). Nov 1977. Contract EX-76-C-01-2276. 88p. Dep. NTIS, PC A05/MF A01.

The micro reactor process variable studies with catalyst SG-A-1, using various synthesis gas compositions, have been completed. Aging studies indicate up to 50 day cycles between regenerations depending on the feed composition used. Micro reactor process variable and aging studies with developmental catalyst SG-B-2 have started. Highest gasoline selectivities were obtained at temperatures less than 500°F. Sulfur resistance of catalyst SG-C-1 was clearly demonstrated at $H_2S$ levels typical of raw synthesis gas from coal (3000 ppM). The process development unit (PDU) has experienced repeated reactor plugging with SG-A-1 and with a larger particle version of this catalyst. The PDU has had about one month of continuous, trouble-free operation with catalyst SG-B-2. Four theoretical studies in support of the process development effort have been completed. Mobil Research and Development Corporation's proprietary catalyst research program has provided three additional catalysts for the contract process studies.

### PREPARATION FROM WASTES OR BIOMASS

*REFER ALSO TO CITATION(S) 21307, 21309, 21361, 22082*

**21258** (SAN—1261/1) **Combustion of Alternative Fuel Study (CAFS).** Saunders, R.B. II. (TRW Systems Group, McLean, Va. (USA)). Apr 1977. Contract EY-76-C-03-1261. 59p. Dep. NTIS, PC A04/MF A01.

Results of a study intended to provide ERDA with a guide to future activities in waste-based fuel combustion hardware research, development and demonstration are reported. Four study activities were undertaken: the identification of the types, quantities and uses of waste fuels that have been considered throughout industry and the literature; the identification of waste combustion hardware manufacturers and potential hardware customers; the investigation of the industrial R and D and governmental agency R, D and D activities germaine to waste combustion technology development; and the sampling of the burner manufacturers' opinions of waste combustion technology development and research priorities. A tentative subprogram activity plan for waste combustion technology development was provided. The plan calls for waste combustion hardware testing and modeling efforts for both direct waste combustion and for the combustion of waste-fed anaerobic digestion and pyrolysis fuels. Investigation of the nontechnical variables that greatly affect waste fuel combustion adaptation and its ultimate configuration are included. These are divided into projects that examine the future price and availability of fuels and develop a methodology for determining the best hardware investments. The output of these studies will be used with technology study results for a systems level trade-off study. This systems study will result in a research, development and demonstration plan that would support the national conservation strategy. (JGB)

**21259** (SHS-IFSY-RU—3) **Survival and dry matter production of some high-yield clones of SALIX and POPULUS selected for forest industry and energy production. Pilot study.** Siren, G.; Sivertsson, E. (Skogshoegskolan, Stockholm (Sweden)). 1976. 46p. Dep. NTIS (US Sales Only), PC A03/MF A01.

Questions on how fast-growing Salix and Populus clones survive and can be produced for forest industry and energy purposes were studied. In connection with the production of cuttings of fast-growing poplars and willows the volume and dry matter production of selected clones were measured. The best clones of one-year-old stem and branch wood produced more than 2.0 kg dry matter per square metre, i.e., about 20 tons per hectare and year. A Salix Smithiana clone (Q666) showed the best results with a total biomass, including leaves and roots, amounting to about 5.2 kg per square metre and year.

**21260 Methane gas process and apparatus.** Boblitz, O.W. (to Bio-Gas Corp.). US Patent 4,057,401. 8 Nov 1977. Filed date 3 Sep 1976. 6p.

Apparatus for manufacture of methane gas from sewage sludge or other organic waste comprises a digester tank system, a solar heating unit and conduit means to use hot air from the solar heater to heat the digester tanks. The new methane gas manufacture methods provided by the apparatus operate with water slurries of organic waste at a temperature of about 100° to 140°F to produce about 11 cu. ft. of gas per pound of organic waste and a dewatered residue that may be used as fertilizer. 5 claims, 4 figures.

**21261 Proteins as a possible source material of low molecular weight petroleum hydrocarbons.** Philippi, G.T. *Geochim. Cosmochim. Acta;* **41**: No. 8, 1083-1086(Aug 1977).

Low temperature cracking experiments of a representative protein, at temperatures not far above the observed temperature range of 130 to 160°C of mature California oil source rocks, indicate the formation of all gaseous and of some gasoline range hydrocarbons of petroleum. Based on protein derivatives only it is estimated that a maximum of at least 3 to 8% by weight of the total organic matter of oil source sediments may be converted into such hydrocarbons. This is in addition to hydrocarbons originating from lipids.

**21262 Svenskt metangasprojekt: ett foerslag med tre alternativ. (Swedish methane gas project: a proposal with three alternatives).** Uppsala; Jordbrukstekniska Institutet (Jan 1977). 29p.

A proposal concerning a BIOGAS project is given. The proposal includes: (a) microbiological research on, e.g., needs for additives to optimize the process, influence of the content of dry substance, high rate digesters, one- or two-stage processing, temperature tolerance, pH regulation, pressure dependence, methods for process regulation, hygienics, foam-quenching; (b) construction of a test plant equipped with instruments for analysis and supervision; and (c) construction of prototype plants at a swine farm and at a slaughterhouse. Detailed budgets and schedules are given for the project at three different possible total costs.

### ALCOHOL FUELS

*REFER ALSO TO CITATION(S) 21868*

### PROPERTIES

*REFER ALSO TO CITATION(S) 21869*

#### CHEMICAL SYNTHESIS

*REFER ALSO TO CITATION(S) 20869, 20870*

#### PREPARATION FROM WASTES OR BIOMASS

*REFER ALSO TO CITATION(S) 21258, 21309, 21310*

### PREPARATION

*REFER ALSO TO CITATION(S) 21304, 21309*

### SOLID WASTE FUELS

*REFER ALSO TO CITATION(S) 21258, 21305, 21306, 21309, 21839, 22083*

### LIQUID WASTE FUELS

*REFER ALSO TO CITATION(S) 21839*

## HYDRO ENERGY

*REFER ALSO TO CITATION(S) 21707*

### RESOURCES AND AVAILABILITY

**21263** (TID—28068) **Planning status report: water resource appraisals for hydroelectric licensing.** (Federal Power Commission, Washington, D.C. (USA). Bureau of Power). 1977. 17p. Dep. NTIS, PC A02/MF A01.

Up-to-date information is provided on water resources in the lower White River Basin for use by the Federal Power Commission and its staff when considering hydroelectric licensing and other work. Data on water resource developments, existing and potential, and on water use by existing and projected thermal generating facilities are included. Past and current planning studies are reviewed and needs for additional planning are identified. The information presented was abstracted from available sources and its assembly involved no new studies.

**21264 Determination of energy generation for a series of power stations connected in cascade, using a regression analysis.** Harboe, R.; Leipold, T. (Univ de Chile). *Oesterr. Z. Elektrizitaetswirtsch.;* **30**: No. 7, 323-331(Jul 1977). (In German).

In planning reservoirs followed by power stations, it is necessary to be able to determine the energy generated in the downstream stations from the releases from the uppermost reservoir. With this objective in mind, a simulation model of the system has been developed which determines the energy generation as a function of the inflow to, the capacity of, and the discharge from, the uppermost reservoir. This function is then tested by regression analyses with different premises. This enables a substantial simplification of the planning problem. The hydraulic structures in the upper course of the river Lech serve as a basis for the development of these model set-ups.

### SITE GEOLOGY AND METEOROLOGY

**21265 Problem of foundation-structure interaction in large dams and other massive systems.** Benedetti, D.; Fontana, A. (Politec di Milano, Italy). *Energ. Elettr.;* No. 5, 254-264(1977). (In Italian).

Reference is made to large dams. First the validity of 2-D analysis is discussed together with the influence on the results connected with soil-structure interaction due to the use of different numerical methods of analysis. The possibility of using "surface elements" to represent the contact effect between structure and soil is shown. Some easily implementable simplifications in the determination of stiffnesses of such surface elements are determined.

### PLANT DESIGN AND OPERATION

**21266** (PB—269254) **Power production at Federal dams could be increased by modernizing turbines and generators.** (General Accounting Office, Washington, D.C. (USA). Energy and Minerals Div.). 16 Mar 1977. 18p. (EMD—77-22). NTIS PC A02/MF A01.

Existing Federal hydroelectric plants could increase power production by modernizing turbines to increase efficiencies and capacities and by modernizing generators to increase capacities. Increasing hydroelectric power production will (1) increase the Nation's energy supply, (2) displace consumption of nonrenewable fuels by fossil-fueled power plants, (3) reduce pollution, (4) increase Federal revenues, and (5) displace or delay construction of alternate power sources. Federal agencies that operate hydroelectric plants should evaluate existing plants to identify and act on these opportunities.

## SOLAR ENERGY

*REFER ALSO TO CITATION(S) 21271, 21388*

### RESOURCES AND AVAILABILITY

**21267** (NBS-BSS—96) **Hourly solar radiation data for vertical and horizontal surfaces on average days in the United States and Canada.** Kusuda, T.; Ishii, K. (National Bureau of Standards, Washington, D.C. (USA). Center for Building Technology). Apr 1977. 410p. Bureau of Standards, Washington, DC.

The majority of the available solar radiation data for the United States and Canada are in the form of either monthly averages of daily total radiation on a horizontal surface or hourly values for cloudless days on horizontal, tilted, and vertical surfaces. Hourly solar radiation data for walls and roofs under "average" solar conditions were computed in order to be able to make estimates of the effect that incident solar radiation has on a building and/or its heating and air conditioning system over a heating and/or cooling season. Calculation procedures developed by Liu and Jordan were modified and hourly solar radiation data were compiled for 80 locations in the United States and Canada. Data were also computed and tabulated for a new parameter called "sol-air temperature for glass."

**21268** (SAND—77-0874) **Estimating monthly means of daily totals of direct normal solar radiation and of total solar radiation on a south-facing, 45°, tilted surface.** Boes, E.C.; Hall, I.J. (Sandia Labs., Albuquerque, N.Mex. (USA)). Jul 1977. Contract EY-76-C-04-0789. 28p. Dep. NTIS, PC A03/MF A01.

Direct Normal, DN, radiation data is presently available for only a few sites in the country while total horizontal, TH, radiation is available for many locations. If a mathematical function relating DN and TH were established, solar engineers could estimate DN for any site for which TH data is available. Total radiated energy on a tilted surface, TT, is also of interest to solar engineers. A recently completed report includes TT values for a surface tilted at 45° for 26 sites. A function relating TT and TH would permit one to estimate TT for sites where only TH data is available. Empirically derived functions relating DN and TH and TT and TH are presented.

**21269** **Sun as a source of energy in Finland.** Hassi, O. (Tampere Tek Korkeakoulu, Tampere, Finl). *Sahko;* **50**: No. 7-8, 219-222(1977). (In Finnish).

The article shows how the power density of radiation on the earth's surface depends on the degree of latitude, season, and the time of day. The variation in diurnal energy density as a function of season is examined on the equator, in Tampere, Finland and at the North Pole. The energy absorption capacity of photosynthesis and solar batteries in Finnish conditions is also examined. 9 refs.

**21270** **Economic trade-offs between the performance of collector thermal performance tests on a solar simulator as opposed to outdoor testing.** Reily, J.C. (NASA/George C. Marshall Space Flight Center, Huntsville, AL); Melton, D.E.; Reese, D.R.; Patrick, S.L.; Losey, R.E. pp 30.17-30.20 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

In 1976 a large Solar Simulator was designed and installed at Marshall Space Flight Center. This Solar Simulator is the largest of its type in the country and has a "working" area of 4 ft x 8 ft. Recently completed comparison tests show excellent correlation with data collected in the natural sun. The Solar Simulator has been in operation since September 1976 and the costs of operation are now determinable together with the cost of design and construction. The total operational costs of obtaining test data using the simulator with analogous costs of testing in the natural sum are compared. In addition, productivity is compared.

## ECONOMICS

*REFER ALSO TO CITATION(S) 21299, 21329*

## ENVIRONMENTAL, LEGAL, AND INSTITUTIONAL ASPECTS

**21271** (SAND—77-1412C) **Solar energy research at Sandia Laboratories with unique health and safety parameters.** Young, L.L. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 40p. (CONF-771067—1). Dep. NTIS, PC A03/MF A01.

From National safety congress, Chicago, IL, USA (18 Oct 1977).

A general review of the major solar energy projects at Sandia Laboratories is given. The Polar Total Energy Test Facility, Solar-Powered Irrigation System, photovoltaics research facilities, and the Solar Thermal Test Facility are described. The hazards associated with the reflection and reradiation of concentrated solar energy from solar collection systems are discussed. The radiation hazard to the retina of the eye is considered in particular. (WHK)

## SOLAR ENERGY CONVERSION

**21272** **Sonnenkraft fuer jedermann. Solarzellen, Sonnenkollektoren mit Anleitungen fuer eigene Versuche. (Solar energy for everybody. Solar cells, solar collectors with instructions for own experiments).** Cobarg, C.C. Stuttgart, Germany, F.R.; Frech (1977). 175p. (In German).

This book presents principles of solar energy utilization techniques. Solar collectors and solar cells, experimental houses and a great number of application possibilities for solar cells in space as well as on earth are reported on. The very much application-oriented presentation is underpinned by a lot of graphical representations. Instructions are given to make own experiments.

### PHOTOVOLTAIC CONVERSION

**21273** (ERDA/JPL/954356—77/3) **Silicon on ceramic process. Silicon sheet growth development for the Large-Area Silicon Sheet Task of the Low-Cost Silicon Solar Array Project. Annual report No. 2, September 17, 1976—September 19, 1977.** Zook, J.D.; Heaps, J.D.; Maciolek, R.B.; Koepke, B.; Butter, C.D.; Schuldt, S.B. (Honeywell Corporate Material Sciences Center, Bloomington, Minn. (USA)). 30 Sep 1977. Contract NAS-7-100-954356. 117p. Dep. NTIS, PC A06/MF A01.

The objective of this research program is to investigate the technical and economic feasibility of producing solar-cell-quality sheet silicon by coating one surface of carbonized ceramic substrates with a thin layer of large-grain polycrystalline silicon from the melt. In the past year significant progress was made in all areas of the program. The physical and chemical properties of the standard mullite refractory used for the majority of the coating runs (McDanel MV20 and Coors S1SI) have been characterized. A number of experimental compositions have been identified and procured from Coors. Characterization of the standard compositions revealed that the thermal expansion of mullite depends on both relative amounts of glass phase and on the impurity level in the glass. Since the thermal expansion in mullite exceeds that of silicon, the silicon coating should be in a state of compression. This was confirmed by x-ray measurements. After modifying and cleaning the dip-coating facility, silicon on ceramic (SOC) solar cells were fabricated which demonstrate that the SOC process can produce silicon of solar cell quality. SOC cells having 1 $cm^2$ active areas demonstrated measured conversion efficiencies as high as 7.2 percent. Typical open-ciruit voltages (V/sub oc/) and short-circuit current densities (J/sub sc/) were 0.51 volt and 20 $mA/cm^2$, respectively. Since the active surface of these solar cells is a highly reflective "as-grown" surface, one can expect improvement in J/sub sc/ after an anti-reflection (AR) coating is applied. Results of an economic analysis of the SOC process are presented.

**21274** (ERDA/JPL/954374—77/3) **Slicing of silicon into sheet material. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Sixth quarterly report, June 18, 1977—September 18, 1977.** Holden, S.C.; Fleming, J.R. (Varian Associates, Lexington, Mass. (USA). Lexington Vacuum Div.). 30 Sep 1977. Contract NAS-7-100-954374. 82p. Dep. NTIS, PC A05/MF A01.

Portions of document are illegible.

The "Multiple Blade Alignment Device" has been reported to JPL as a New Technology item, and is currently being reviewed for patent potential. The device has proven difficult to install on a blade package. Successful engagement of the device has resulted in an intrinsic parallelism of the ends of the package to within 3μ, compared to standard errors prior to correction of over 50μ. Measurements of blade misalignment indicate an average runout of 50μ in a 220 blade package. This compares well with predictions based on thickness variation measurements of blades and spacers. Early cutting tests with 0.15 mm blades and 10 cm diameter ingots show lower yield and accuracy and higher cutting speed than previous standard tests. This seems to be a result of effective high abrasive concentration on the blades as a result of the slurry application technique. A similar, more dramatic reduction of yield occurs with a thin slurry oil. This appears to occur by increased slurry transport to the blades and another effective increase of abrasive packing to the cutting region. Design of the large capacity MS saw is proceeding well, with a final conceptual design in progress. A flywheel system for work-piece drive is described. The design offers a practical conservative motion for the drive, requiring a minimum of power. 10 cm MS slices have been sent out for solar cell fabrication. 10 cm diameter and 2 cm square MS slices have been delivered for various surface preparations, and will be fabricated into cells and evaluated for performance. This will develop a minimum surface removal technique for both the damage and profiles peculiar to thin MS sices while allowing high efficiency cell production.

**21275** (ERDA/JPL/954458—77/6) **Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July—September 1977.** Kolyer, J.M.; Mann, N.R. (Rockwell International Corp., Anaheim, Calif. (USA). Autonetics Group). 7 Oct 1977. Contract NAS-7-100-954458. 23p. Dep. NTIS $4.00.

To meet the goals of th LSSA program, solar cell encapsulants must provide protection for 20 years. Consequently, the objective of the present program is to develop methodology for making confident predictions of encapsulant performance at any exposure site in the U.S.A. During the first year of the program, inherent weatherability was studied. Inherent weatherability is controlled by the three weather factors common to all exposure sites: insolation, temperature, and humidity. Emphasis was focused on the transparent encapsulant portion of solar cell arrays by eliminating weathering effects on the substrate and circuitry (also parts of the encapsulant system). Accordingly, inert ceramic substrates with gold circuitry and contacts were selected. An accelerated test was conducted to

define failure modes and to provide quantitative rate data. Relative effects of UV light, temperature, and moisture were disclosed. This information was used in conjunction with weather data to allow predictions for the moisture-related deterioration of solar cell metallization, the change of properties (yellowing, tensile strength, gloss retention) for Lexan encapsulant covers, and the change of properties for polystyrene. Polystyrene degrades readily and gives rate data useful for mathematical modeling trials. The most extensive data were for yellowing, which was measured conveniently and precisely. Considerable data also was obtained on tensile strength. Changes in these two properties after outdoor exposure were predicted very well from accelerated exposure data.

**21276** (ERDA/JPL/954471—77/3) **Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977—July 31, 1977.** Kapur, V.K.; Nanis, L.; Sanjurjo, A. (Stanford Research Inst., Menlo Park, Calif. (USA)). Sep 1977. Contract NAS-7-100-954471. 28p. Dep. NTIS, PC A03/MF A01.

The leaching of sodium fluorides from the products of the $SiF_4$-Na reaction was studied in detail. The leaching process was rapid, with most of the NaF being dissolved within fifteen minutes in the first wash of the reaction products. Acids such as HCl, HF, $CH_3COOH$, and $H_2SO_4$ were all found to be good leachants; $H_2SO_4$ was slightly better in this respect than the other acids. The acid normality in the range 0.012 N to 1.2 N had no significant effect on the leaching process. Stirring and heating (to 75°C) were found to hasten the leaching process. The effects on the leaching process of the reaction products' particle sizes were not very substantial for particles in the range 0.043 to 1.17 mm. The presence of sparingly soluble $Na_2SiF_6$ in the $SiF_4$-Na reaction products slowed the leaching process, so that complete removal of fluoride compounds from the reaction products required two or three consecutive washes. Silicon tetrafluoride gas was prepared from commercially obtained aqueous $H_2SiF_6$ (25 wt%) with at least a 92% yield. Mass spectrometric analysis showed that the $SiF_4$ thus obtained was purer than that obtained commercially.

**21277** (ERDA/JPL/954605—77/3) **Development of low-cost, high energy-per-unit-area solar cell modules. Quarterly report No. 3, July 1, 1977—September 30, 1977.** Jones, G.T.; Chitre, S. (Sensor Technology, Inc., Chatsworth, Calif. (USA)). Sep 1977. Contract NAS-7-100-954605. 36p. Dep. NTIS, PC A03/MF A01.

Hexagonal solar cells were processed and utilized in the development of low-cost, high energy-per-unit-area solar cell modules. Electrical performance was studied for solar cells with two different grid patterns, each pattern covering the same amount of cell surface area. Very little difference in electrical performance was observed. The laserscribe hexagonal solar cell computer program was delivered. It met all required specifications. A detailed analysis was made on the solar cell junction current leakage prior to and after laserscribing. It was found that the laserscribe can cut through the p-n junction without damaging the junction. It significantly reduces junction current leakage which for our solar cells is primarily due to edge effects. The junction current leakage caused by edge effects from the laserscribe is uniform, consistent and very small. Surface macrostructure process equipment suitable for wafer production quantitites was delivered. Experimentation with this equipment was performed to optimize the texturizing process. Diffusion process techniques were optimized and a detailed technical and economic analysis of the process was made. Silicon wafer spin-on antireflection coating and high pressure cleaning equipment was ordered. SAMICS - Format A was written out for technical and economic evaluation of the hexagonal solar cell process sequence.

**21278** (ERDA/JPL/954777—77/1) **Silicon halide—alkali metal flames as a source of solar grade silicon. First quarterly report.** Miller, W.J. (Aerochem Research Labs., Inc., Princeton, N.J. (USA)). Sep 1977. Contract NAS-7-100-954777. 20p. (AeroChem-TN—178). Dep. NTIS, PC A02/MF A01.

This program is designed to test the feasibility of utilizing continuous, high temperature, diffusion flames of gaseous alkali metals and silicon halides as an economical source of high purity silicon. Thermochemical analyses of these systems indicate that high temperatures are attained and that silicon is the only condensed-phase material in the equilibrium product distribution. The reactions are self-initiating and their highly exothermic nature indicates, by analogy to more conventional combustion systems, that the resulting flames will be self-sustaining and characterized by fast kinetics. A series of detailed thermochemical calculations was performed to determine comparative flame properties as functions of input composition, temperature and pressure. Vapor generators for both liquid halides and alkali metals were built, tested and installed in a low pressure burner housing. Counterflow diffusion flames of K vapor with $SiCl_4$ were sustained at low pressures with and without Ar diluent. The products, when allowed to condense in the reactor volume or on its walls, comprise a mixture of white and brown powders, which are readily separated by washing with water; the brown material appears to be amorphous silicon.

**21279** (N—77-26222) **Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster.** Gruber, R.P. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Mar 1977. 25p. (NASA-TM-X—73643; E—9148). NTIS PC A02/MF A01.

A new solar array/ion thruster system control concept has been developed and demonstrated. An ion thruster beam load is used to automatically and continuously operate an unregulated solar array at its maximum power point independent of variations in solar array voltage and current. Preliminary tests were run which verified that this method of control can be implemented with a few, physically small, signal level components dissipating less than two watts.

**21280** (PB—269587) **Feasibility investigations of growing and characterizing gallium arsenide crystals in ribbon form. Semi-annual progress report 1 January—30 June 1975.** Berkowitz, J.B. (Little (Arthur D.), Inc., Cambridge, Mass. (USA)). Jul 1975. 24p. (NSF/RANN/SE/GI—43093/PR/75/2). NTIS PC A02/MF A01.

An eighteen month program was initiated July 1, 1974 to determine the feasibility of producing GaAs single crystal ribbons suitable for solar cell substrates. The objective of this program is to grow 10 cm x 1 cm x 0.1 cm single crystals by a process that is amenable to continuous growth. Single phase, directionally solidified polycrystalline gallium arsenide ribbons, 0.1 cm x 1 cm x 4 cm, have been grown by passage of a molten zone through feed-stock confined with a graphite cavity. Arsenic vaporization was suppressed through the use of a boron oxide moat seal and an overpressure of 3 atm. of nitrogen. Apparatus design changes are in progress for adjustment of heat flow and temperature patterns to promote single crystal growth.

**21281** (PB—269670) **Research and development of low-cost processes for integrated solar arrays. Semi-annual report No. 3, 1 January—30 June 1975.** Graham, C.D.; Kulkarni, S.; MacDiarmid, A.G.; Noel, G.T.; Pope, D.P. (Pennsylvania Univ., Philadelphia (USA)). Jul 1975. 100p. NTIS PC A05/MF A01.

An investigation of techniques for upgrading metallurgical-grade silcon indicates that reactive gas blowing and uni-directional freezing can significantly lower the concentration of most of the primary impurities present, with the exception of boron. Electrolytic processes for silicon production are not attractive for this program because of low deposition rates and high cost. Transport of $SiF_2$ over considerable distances, at atmospheric pressure, without decomposition has been demonstrated at both high (>1000 C) and low (<100 C) temperatures. Polycrystalline silicon has been uni-axially deformed as much as 70% with deformation rates up to 1%/second at temperatures >1250 C. A 'Pierce Gun' zone melting system has been constructed for recrystallization experiments. A revised economic analysis of the Czochralski crystal pulling process is presented.

**21282** (PB—269671) **Thin film solar cells for terrestrial applications. Quarterly progress report no. 4, 1 April—30 June 1975.** Shirland, F.A.; Biter, W.J.; Greeneich, E.W.; Brody, T.P. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). Aug 1975. 91p.

Improvements in barrier formation and in rinsing after barrier formation resulted in increases in standard process cell efficiencies to an average level of 5.0%. Difficulties with evaporated grids causing lowering of cell output have been ascribed to localized shorting effects. The use of a p(+) layer, such as sputtered Cu2S, between the cell barrier layer and the evaporated grid appears to be a way around these difficulties. Real time roof top life tests of encapsulated CdS cells show no loss of output at 5 months' exposure. Accelerated tests show no loss of output after 6 months of accelerated exposure, even at operating temperatures of 100 degrees C. Some changes in basic cell parameters are occurring on the accelerated test which should eventually affect cell outputs and which may be correlatable with specific modes of degradation.

**21283** **Efficiency of grating solar cells.** Kong, A.K.; Green, M.A. (School of Electrical Engineering, University of New South Wales, Kensington, Australia). *J. Appl. Phys.;* **49**: No. 1, 437-442(Jan 1978).

Computer simulation of grating solar cells is used to compare the performance of this type of device with more conventional cell geometries. Criteria for the grating design and their dependence upon substrate properties are discussed. The nature of the back contact to the cell is shown to play an important role in determining the cell efficiency. In order for the grating cell to be competitive in efficiency with the normal cell geometry, the back contact must have minority-carrier blocking properties. The efficiency of cells with ideal Ohmic back contacts is limited by geometrical effects. Recent experimental results are analyzed in terms of the results of the theoretical investigation.

**21284** **Model calculations for metal-insulator-semiconductor solar cells.** Olsen, L.C. (Jt Cent for Grad Study, Richland, Wash). *Solid-State Electron.;* **20**: No. 9, 741-751(Sep 1977).

An analytical approach to calculating MIS solar cell properties has been formulated and utilized to study solar cell efficiency as a function of interfacial layer thickness, various interfacial film parameters and band gap. Three models are considered regarding interface state recombination kinetics. It is found that in all three cases, the efficiency of low barrier height, Schottky barrier cells can be increased very significantly. It is determined, however, that MIS solar cell performance is limited by leakage currents due to minority carrier diffusion back into the bulk. As a result the upper limit of performance is defined by that for a homojunction. These calculations indentify ranges of surface state density and interfacial barrier heights necessary for a good MIS solar cell. 13 refs.

**21285 Theoretical effects of surface diffused region lifetime models on silicon solar cells.** Dunbar, P.M.; Hauser, J.R. (NC State Univ, Raleigh). *Solid-State Electron.;* **20**: No. 8, 697-701(Aug 1977).

A computer simulation of silicon solar cells has indicated that the combination of band gap reduction due to heavy doping and certain spatial forms of lifetime dependence can combine to form severe limitations to the open circuit voltage of silicon solar cells. The interaction of these effects tends to shift the active region of the diffused surface layer away from the injecting junction resulting in an increase in the current density injected into the surface region. Reductions in open circuit voltage as great as 10% over models which do not include these effects can be seen. 13 refs.

**21286 CdS-CdTe solar cell prepared by vapor phase epitaxy.** Yamaguchi, K.; Nakayama, N.; Matsumoto, H.; Ikegami, S. (Matsushita Electr Ind Co, Osaka, Jpn). *Jpn. J. Appl. Phys.;* **16**: No. 7, 1203-1211(Jul 1977).

CdS-CdTe solar cells were prepared by epitaxial growth of CdS on p⁺CdTe wafers, and properties of the cells were extensively studied. The cells have a junction structure of n⁺CdS-(n or i)⁺CdTe-p⁺CdTe. Formation of the (n or i) layer is due to diffusion of In into CdTe; the thickness of the layer was 0.5 μm in the most efficient cell. The best cell exhibited a solar conversion efficiency of 10.5% under illumination by sunlight (AM1.3, 68 mW/cm²), and 6.0% under illumination by a simulated sunlight (AMO). The high efficiency is attributed to the reduction in both the series resistance and surface recombination, which results from the presence of the heavily doped CdS layer on the wafer. The cell is not humidity sensitive and is stable in the forward bias test. These results suggest strongly that practically useful solar cells can be manufactured from this type of junction. 25 refs.

**21287 Technology of large area $Cu_2S$-CdS solar cells.** Schock, H.W.; Bilger, G.; Bloss, W.H.; Hewig, G.H.; Pfisterer, F. (Univ of Stuttgart, Ger). *Vacuum;* **27**: No. 4, 281-285(Jun 1977).

Solar energy can be converted in different ways: the most attractive application is the direct conversion of solar radiation to electricity. For large scale application large area photovoltaic devices are necessary. Highly efficient solar cells can be produced on the basis of thin semiconducting films. An automized pilot line production for CdS layers, which are evaporated under high vacuum conditions, and their subsequent treatment to get an encapsulated thin film solar cell, are described. Investigation methods and a theoretical model of the heterojunction are reported. 11 refs.

**21288 Back wall Schottky barrier solar cell with an interfacial layer.** Bhattacharya, K.; Basu, P.; Saha, H. (Univ of Kalyani, India). *Phys. Status Solidi (a);* **41**: No. 1, 317-321(May 1977).

The role of an interfacial layer is discussed in the case of a back-wall Schottky barrier solar cell. Computations are made for both, Si and GaAs cells to study the dependence of V/sub oc/ and eta of the cells with the parameters of the interfacial layer. It is concluded that eta ≃ 15 and 7% may be realised for the GaAs and Si cells with phi/sub B/ ≃ 0.8 and 0.7 V, respectively, in presence of a suitable interfacial layer. 7 refs.

**21289 Minority carrier MIS solar cell.** Pulfrey, D.L. (Univ of BC, Vancouver). *Solid-State Electron.;* **20**: No. 5, 455-457(May 1977).

MIS solar cells are described which exhibit high fill-factors and open-circuit voltages and which have dark, forward bias I-V characteristics of a double exponential form. The insulator formation was achieved by a low temperature oxidation in air and an optimum insulator thickness of 12-15 A was observed. The device properties suggest that the diodes may be operating in a recently-described, nonequilibrium, minority carrier, tunnel mode. 15 refs.

**21290 Radiation resistance of silicon photoconverters with built-in electrical field in the base.** Gerasimova, E.M.; Grigor'eva, G.M.; Chetverikova, G.A. (All-Union Sci Res Inst for Current Sources, USSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 1-5(1977).

The radiation resistance of Si photoconverters having a built-in electric field in the base is considered for their irradiation with 6.3 MeV protons. The spectral and current-voltage characteristics of such photoconverters are investigated for various irradiation doses. The way in which the photoconverter radiation resistance depends on the magnitude of the built-in electric field is determined. Photoconverters with built-in electric field exhibit higher radiation resistance even at electric fields of about 20 V/cm.

**21291 Economical photovoltaic power generation with heat recovery.** Ascher, G. (NASA, Goddard Space Flight Cent, Greenbelt, Md). pp 277-280 of In Proceedings of the Institute of Electrical and Electronics Engineers conference. New York; Institute of Electrical and Electronics Engineers (1977).

From Institute of Electrical and Electronics Engineers conference; Williamsburg, VA, USA (4 Apr 1977).

Three designs for conversion of solar radiation into electricity and thermal energy are offered. The objective of these converters is to increase the electrical and thermal output for each photovoltaic array, so that the cell cost is lowered relative to the amount of energy delivered by the device.

**21292 Silicon for solar cells.** Brissot, J. (Lab d'Electron et de Phys Appl, Limeil-Brevannes, Fr). *Acta Electron.;* **20**: No. 2, 101-116(1977).

After a definition of requisites for an inexpensive industrialization of silicon solar cells for terrestrial applications, the different methods of elaboration of the silicon element are chronologically described as well as those of a solar grade material. It is shown that the fabrication of low cost cells requires the study of new growth processes. In this prospect the main methods known so far are successively reviewed in the field of single crystal ribbons and polycrystalline layers. 74 refs.

**21293 Structures of photocells: homojunctions, heterostructures or heterojunctions.** Fabre, E. (Lab d'Electron et de Phys Appl, Limeil-Brevannes, Fr). *Acta Electron.;* **20**: No. 2, 117-131(1977).

This paper deals with a comparative analysis of the different possible structures for the solar cells, and it is shown that the determination of the best structure mostly depends upon the physical characteristics of the base material, and especially its band structure. The three main types of collecting junctions (homojunction N/P, Schottky or MIS barrier, heterojunction) are analysed in the two particular cases of an indirect band gap semiconductor (silicon) and a direct band gap semiconductor (gallium arsenide). Finally, the copper sulfide material is also presented as an example of polycrystalline thin films. 38 refs.

**21294 Single crystal silicon photocells for terrestrial use: state of the art and future prospects.** Michel, J. (Lab d'Electron et de Phys Appl, Limeil-Brevannes, Fr). *Acta Electron.;* **20**: No. 2, 133-151(1977).

The main drawback of the single crystal silicon photocells with a P/N junction is their cost which means that the electric energy thus produced is expensive. The aim of this paper is to show that some solutions can be found for reducing this cost. Firstly an industrial fabrication process for the photocells is described with reference to its limitations and the encountered problems. Secondly the possibilities of reducing the panel cost are investigated: increase in the diameter of the silicon ingot and a decrease in the thickness of the silicon used for each wafer; modifications of the realization process with respect to the $N^+$ layer, the metallization deposit and the antireflective coating; optimization of encapsulation by increasing photocell density and panel surface. Another means of reducing the cost of the produced energy is to increase the energy conversion efficiency by improving the short-circuit current (better absorption and greater spectral sensitivity) and the open-circuit voltage. In conclusion, some data are provided for an economic comparison between single crystal silicon photocells and photocells made from less expensive base material (especially polycrystalline silicon). 23 refs.

**21295 General considerations concerning simple concentrators for photovoltaic cells.** Bellugue, J. (Lab d'Electron et de Phys Appl, Limeil-Brevannes, Fr). *Acta Electron.;* **20**: No. 2, 153-164(1977).

Concentration of solar light which appears, at first sight, to be a simple means of decreasing photovoltaic watt cost is in fact a delicate process and demands a very intricate optical concentration system whose efficiency has the same function as that of the illuminated cell. In fact this system should be considered as a veritable optical instrument. For simple concentration there are general relations between pointing precision, concentration value and optical efficiency and the problem can thus be well stated. The different types of simple concentrator--mirror or cylindrical lens, combination of conical mirrors, combination of parabolic mirrors, Fresnel lens and complementary combination of these devices among each other--must be carefully studied or else, either their optical efficiency is disastrous, or they are limited to very low concentrations, or the light spot they supply endangers the photovoltaic cell.

**21296 Problems relative to the adaptation of photocells to terrestrial applications.** Naaijer, G. (Lab d'Electron et de Phys Appl, Limeil-Brevannes, Fr). *Acta Electron.;* **20**: No. 2, 165-185(1977).

The characteristics of a silicon photovoltaic cell (dia 0.57 mm, encapsulated) are briefly recalled and a practical mathematical model is established. Its particularities and possibilities, which are often unexpected, are then illustrated with a series of practical examples of low power terrestrial utilisations. With a single cell the following can already be realized; solar motors and pendulums; distress micro-transmitters; power supplies for pocket calculators or clocks with liquid crystal display, and discharge tube blinker lights. With a series of thirty four cells a 12 V battery can be kept charged (thus prolonging its lifetime) for holiday homes, flying insect exterminators, etc. Between these two extremes power supply of $I^2L$ and CMOS circuits, <<heliogyrators>>, electrolysis, refining, and cathodic protection against corrosion of metallic objects in contact with a damp environment should be mentioned. The most important aspects of adaptation and the appropriate solutions illustrate the fact that the photovoltaic effect and all its particularities can best be put to use by specific engineering. The subjects as follows are therefore approached: series/parallel association of cells with protection measures (by diodes), energy storage devices; adaptors/converters; adaptive associations; simple solar tracking system without concentrators.

**21297 Examples of applications of RTC terrestrial solar units from 1961 to 1977.** Dalibot, B. (RTC La Radiotech-Compelec, Paris, Fr). *Acta Electron.;* **20**: No. 2, 187-195(1977).

The aim of this article is to present solar generator applications, realized by RTC La Radiotechnique-Compelec which exist today. Brief data are given about each type of application and illustrated by photographs of equipment.

**21298 Relative cost-performance of various solar-based power supply packages.** Begemann, S.H.A.; Jansen, P. (Philips Res Lab, Eindhoven, Neth). *Acta Electron.;* **20**: No. 2, 197-204(1977).

The development or improvement of various solar-based systems to produce electricity is creating many new possibilities to provide power in places where an electric utility distribution system is lacking. The extent to which solar-based systems will be used depends on the overall cost-performance of these new systems compared to the conventional systems. Several of the more promising continuous and autonomous solar-based power supply systems for applications requiring daily availability of a given (small) number of kWh's have been computer simulated for six different climatic regions. The cost-performance of these systems was calculated for the different climates for the next ten years, taking into account an expected price decrease of photovoltaic cells, to determine its effect on the relative cost-performance of the various systems. The systems chosen consisted of batteries (storage system) and one (simple system) or more (of hybrid system) of the following generating components: photovoltaic cells, wind generators and conventional generator. The results show the importance of choosing the right generating component(s) for a particular climate and the significant improvement in cost-performance when two or more different generating componets are combined in a hybrid system.

**21299 Near-term prospectives for photovoltaic solar energy conversion.** Wolf, M. (Univ of Pa, Philadelphia). *Acta Electron.;* **20**: No. 2, 205-215(1977).

The newly developing terrestrial market is the one expected to grow rapidly, with annual doubling forecast. The technology development during the next 5 years will be oriented towards the array efficiency and reliability improvement with simultaneous cost reduction. In the time frame considered, only those technology changes can be expected to find their way into production which are already quite advanced in development. Thus, the bulk of product will be based on the single crystal silicon cell, with the single crystal GaAlAs/GaAs and the thin film $Cu_2S$/CdS cells likely also being tried in the market-place during this period. The process development will also be based largely on existing technologies, with extensive mechanization taking place short of full automation. A price/demand curve for solar arrays has been developed as a market forecasting tool which, however, leaves many questions with respect to the near-term market still unanswered. 33 refs.

**21300 Growth and characterization of VPE thin-film AlAs—GaAs heterojunction layers.** Johnston, W.D. Jr.; Callahan, W.M. (Bell Labs., Holmdel, NJ). pp 311-316 of In Gallium arsenide and related compounds (St. Louis), 1976. Eastman, L.F. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; St. Louis, MO, USA (26 Sep 1976).

See CONF-7609148—.

GaAs layers have been grown by HCl transport vapour phase epitaxy (VPE) on conducting graphite substrates. p-type (Zn-doped) GaAs films have been grown with low-resistance ohmic contact to the graphite. VPE films of n-AlAs (no deliberate dopant) have been grown on top of these GaAs layers. Such a structure has potential application for terrestrial solar photovoltaic energy conversion. Our measurements on this polycrystalline heterostructure material indicate that the p-n junction is properly located at the AlAs-GaAs interface. Good contacts to the polycrystal AlAs can indeed be made, and the stability of the polycrystal AlAs is adequate to permit device processing, although long-term exposure to a humid environment will require protective encapsulation. The internal quantum efficiency of the cells has been inferred (from photocurrent response spectra) to exceed 90%. The dark junction characteristics of cells several $cm^2$ in area, as measured with broad-area contacts, indicate efficiencies in excess of 15% at air mass (AM) 1.5 should be possible, if high spreading resistance in the top layer can be overcome by an improved contact grid.

## THERMIONIC AND THERMOELECTRIC CONVERSION

**21301 Some problems involved in the development of a solar thermionic power plant.** Grigor'ev, E.I.; Zaitsev, V.M.; Mel'nikov, M.V.; Nevezhin, O.A.; Ovchinnikov, V.S.; Poluektov, V.P.; Ryabikov, S.V.; Rubanovich, I.M.; Khudyakov, S.A.; Yurin, E.M. (All-Union Sci-Res Inst of Current Sources, USSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 6-10(1977).

A thermionic energy converter intended for development of a solar power plant is considered; the plant is to operate under conditions of high equilibrium ambient temperatures. Experimental data are reported for laboratory and solar tests of the thermionic converter; data are analyzed. The test stands are described.

## BIOMASS PRODUCTION AND CONVERSION

*REFER ALSO TO CITATION(S) 21258, 21259, 21312, 21361, 22082*

**21302** (CONF-770235—) **Fuels from biomass program: thermochemical coordination meeting.** (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Solar Energy). 23 Feb 1977. Contract EY-76-S-04-3779. 167p. Dep. NTIS, PC A08/MF A01.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

Six papers have been abstracted and indexed individually for ERA/EDB. (JGB)

**21303** (CONF-770235—, pp 23p, Paper 1) **Rotary kiln gasification of biomass and municipal wastes.** Hooverman, R.H.; Coffman, J.A. (Wright-Malta Corp., Ballston Spa, NY). 23 Feb 1977.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

In Fuels from biomass program: thermochemical coordination meeting.

A rotary kiln gasifier-gas turbine generator system is being developed for the clean, efficient recovery of energy from biomass and wastes. Solids and liquids combined are dried, pyrolyzed, and steam-gasified during slow passage through a continuous-feed, externally-heated rotary kiln. The low-Btu product gas fuels a gas turbine generator, and the turbine exhaust provides process heat for the gasifier. Neither shredding, classifying, nor preliminary drying of the charge is necessary; and in principle the efficiency of the system can be as high as that of a combined cycle plant burning conventional fuels. The steam-gasification chemistry has been demonstrated in a bench-scale, batch-feed "mini-kiln." In this equipment paper, wood, and municipal solid and sewage wastes have been gasified under various conditions of steam flow, temperature, pressure, and heating rate. This work has established the feasibility of low-temperature steam gasification and indicated the optimum process conditions.

**21304** (CONF-770235—, pp 55p, Paper 3) **Application of SGFM technology to other feedstocks: status report.** Huffman, W.J.; Halligan, J.E.; Bartsch, R.A.; Peterson, R.L.; de la Garza, E.; Landeene, B.C.; Hillman, P.E. 23 Feb 1977.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

In Fuels from biomass program: thermochemical coordination meeting.

This status report is presented in three sections. The first section presents an overview of the project as well as recent results on the gas phase composition in the Synthesis Gas From Manure (SGFM) reactor. The second section discusses the results of bench-scale pyrolysis of tar products collected from the large-scale, SGFM reactor. All of the results were directed towards identifying the controlling chemistry, reaction kinetics, and operating parameters which could affect scale-up of the process. A major part of the work was to identify the reaction pathway for the production of ethylene from the SGFM reactor.

**21305** (CONF-770235—, pp 37p, Paper 3) **Forest industry energy program: direct conversion.** Arola, R.; Zerbe, J. 23 Feb 1977.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

In Fuels from biomass program: thermochemical coordination meeting.

Results of a survey on the feasibility of direct conversion of forests waste to fuels are reported. It is concluded that residue

combustion equipment is available to meet most of the industries' needs. Steam boiler technology is well established and improvements are supported by the industry. Special combustors present new capablilites for some special applications. Emission control standards have an impact on residue combustion implementation. The key issue in residue combustion systems is the moisture content of the fuel which can adversely influence overall costs of achieving thermal recovery and meeting environmental standards. It is stated that wood will not solve the nation's problems, but can make forest industries approach energy self-sufficiency. It can also make other industries more energy self-sufficient. An example for approaching energy self-sufficiency in a forest products operation is described. (JGB)

**21306** (CONF-770235—, pp 20p, Paper 4) **Conversion of biomass materials into gaseous products. Bimonthly technical status report, December 15, 1976—February 15, 1977.** Garrett, D.E. 23 Feb 1977.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

In Fuels from biomass program: thermochemical coordination meeting.

The technical and economic feasibility of a process for the thermal conversion of biomass (agricultural residues) into an industrial fuel gas is being evaluated. For this purpose a bench-scale reactor was designed, constructed and is now being operated with cattle manure as the feed material. Results of pilot plant and laboratory tests are reported.

**21307** (CONF-770235—, pp 11p, Paper 5) **Preliminary experimental plan bench scale research in support of Albany Development Facility.** 23 Feb 1977.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

In Fuels from biomass program: thermochemical coordination meeting.

The preliminary experimental plan for research in support of the Albany, Oregon Waste-to-Oil Facility includes the following tasks: determine the effect of using low pressure and a recycle oil vehicle; identify the carbon monoxide requirement; and product oil recycle and characterization. (LS)

**21308** (CONF-770582—1) **Biomimetic approach to solar energy conversion.** Katz, J.J.; Janson, T.R.; Wasielewski, M.R. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 67p. Dep. NTIS, PC A04/MF A01.

From Karcher symposium on energy and the chemical sciences; Norman, OK, USA (7 May 1977).

A biomimetic process is carried out in vitro by an inanimate system or apparatus and is based on methods used by living organisms. Specifically, the prospects for using the methods of plant photosynthesis for solar energy conversion are considered. The discussion is presented under the following headings: biomimetic technologies; the photosynthetic unit; chlorophyll as electrophile (acceptor); chlorophyll as donor; photoreaction center chlorophyll; chlorophyll--water adducts; electron spin resonance properties of chlorophyll--water adducts; photoreaction center chlorophyll; the special pair; models for photoactive chlorophyll special pairs; synthetic photoreaction centers; and biomimetic light energy conversion. It is concluded that the prospects for the ultimate success of biomimetic technologies for solar energy conversion depend on the extent to which the details of plant or bacterial photosynthesis are delineated. Although significant advances have been made in the past few years, formidable problems remain. (JGB)

**21309** (MTR—7347(Vol.5)) **Silvicultural biomass farms. Volume V. Conversion processes and costs.** Bliss, C.; Blake, D.O. (Mitre Corp., McLean, Va. (USA). METREK Div.). May 1977. Contract EX-76-C-01-2081. 279p. Dep. NTIS, PC A13/MF A01.

An assessment of the products and processes that appear to be the candidates for the conversion of wood biomass to energy forms suited to the national energy scene is presented. Identification was achieved by comparing market-oriented selling prices of competitive products projected for the future with estimations of production-oriented selling prices utilizing wood-biomass feedstocks needed to make the production attractive to the investor. The products assessed include: electricity from combustion of wood, wood and wood charcoal in combustion with oil or coal, ammonia, methanol, medium-Btu fuel gas, substitute natural gas, and ethanol. Conversion technologies are reviewed and data and information gaps for ultimate design of viable processes are identified as an input to the formulation of research and development needs.

**21310** (NP—22159/2) **Economic pre-feasibility study: large-scale methanol fuel production from surplus Canadian forest biomass. Part 2. Working papers.** (InterGroup Consulting Economists Ltd., Winnipeg, Manitoba (Canada)). Sep 1976. 249p. Dep. NTIS (US Sales Only), PC A11/MF A01.

Working papers supporting information presented in NP--22159/1 are included. The research presented deals with the practicability of using methanol produced from surplus renewable Canadian forest roundwood as a substitute for non-renewable hydrocarbons in meeting Canadian energy requirements. Titles of the five working papers are: methanol plant technologies, characteristics and costs; resource harvesting; opportunity costs; product demand analysis; and alternative feedstocks for methanol production. (JGB)

**21311** (TID—27702) **Cultivation on sewage of microalgae harvestable by microstrainers. Progress report.** Benemann, J.R.; Koopman, B.L.; Weissman, J.C.; Eisenberg, D.M.; Oswald, W.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1977. Contract W-7405-ENG-48;EY-76-S-03-0034-251. 225p. Dep. NTIS, PC A10/MF A01.

The development of biomass production technology for planktonic microalgae was studied. Two methods of algal species control are presented in detail—the theory of size selective biomass recycle and the selection and cultivation of nitrogen-fixing blue-green algae. In the outdoor experiments, circular 3 $m^2$ ponds were used and were fed daily settled sewage, were mixed with paddle wheels, and were maintained at a variable detention time and fixed depth (10 inches). The ponds were inoculated with the filamentous blue-green Oscillatoria. Due to poor growth, the Oscillatoria culture could not be maintained for long against an invading Scenedesmus sp. The naturally appearing alga—Micractinium, a colonial, spiny green algae which harvested well with microstrainers—was much more successful in maintaining itself in the experimental ponds. However, even this species could not survive adverse conditions despite extensive recycling. Selective biomass recycle is not a sufficient tool in itself for sustained species control. Laboratory experiments concentrated on demonstrating the selective recycle theory. A mixture of Spinulina (a filamentous blue-green algae) and a small unicellular green algae could be maintained with either organism predominating depending on recycling. The growth requirements of two Spirulina species were studied in batch cultures in the laboratory where they were found to be similar to other blue-green algae. Tolerance of high salts and alkalinities accounts for the predominance of Spirulina under these conditions. Small outdoor sewage ponds inoculated with Spirulina confirm these findings as well as the effect of long detention times on culture maintenance. Algal harvesting by microstraining is an economically favorable method for small-scale waste treatment systems (10 MGD) and could become sufficiently inexpensive for large-scale systems (100 MGD) to allow algal biomass production with minimal waste treatment credits. (JGB)

## PHOTOCHEMICAL AND THERMOCHEMICAL CONVERSION

*REFER ALSO TO CITATION(S) 21245*

**21312** (CONF-760889—) **International conference on the photochemical conversion and storage of solar energy.** Hofman, M.Z. (Boston Univ., Mass. (USA). Dept. of Chemistry). 31 Jan 1977. Contract EX-76-C-23-1010. 101p. Dep. NTIS, PC A06/MF A01.

From International conference on photo conversion and storage of solar energy; London, Ontario, Canada (24 Aug 1976).

Abstracts are given for the eight formal lectures and the contributed papers from delegates which were presented in the form of posters. There were seven sessions divided by subject as follows: (1) photochemistry, (2) electron transfer mechanisms in photochemical energy conversion processes, (3) photoelectrolysis, (4) photogalvanics, (5) photochemical production of fuels in homogeneous solutions, (6) membranes for photosynthesis reactions, and (7) nonbiological systems for organic molecular energy storage. (WHK)

**21313** (UCID—17535) **Evaluation of the photochemical production of hydrogen from solar energy.** Heppert, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Aug 1977. Contract W-7405-ENG-48. 11p. Dep. NTIS, PC A02/MF A01.

The potential for utilizing solar energy through photochemical storage were investigated. Both water and nitrosyl chloride systems are examined. A comprehensive review of the literature led to the conclusion that many major questions must be answered before photochemical energy storage becomes a viable alternate means of exploiting solar energy.

**21314** **Solar energy conversion.** Kilby, J.S.; Lathrop, J.W.; Porter, W.A. (to Texas Instruments Inc.). US Patent 4,021,323. 3 May 1977. Filed date 28 Jul 1975. 12p.

Solar energy conversion is provided by a structure formed of a plurality of photovoltaic sources. An electrolyte wets the sources. Upon exposure to light the photovoltaic sources cause a current to flow in the electrolyte producing an elctrochemical reaction. The products of this reaction may then be collected and stored. In a preferred embodiment the electrolyte is an aqueous solution of hydrogen iodide, and the hydrogen produced by the electrochemical

reaction may be stored, burned as a fuel or used in a fuel cell to produce electrical energy. 9 claims, 14 figures.

**21315 Photoelectrolysis of water by solar radiation.** Nozik, A.J. (to Allied Chemical Corp.). US Patent 4,011,149. 8 Mar 1977. Filed date 17 Nov 1975. 14p.

Photoelectrolysis of water by solar radiation to produce hydrogen is achieved using semiconducting thin film electrodes. The cell comprises (a) an electrode comprising at least one thin film semiconducting layer disposed on a substrate, each layer having a bandgap which ranges from about 1.3 to 4.0 eV; (b) a counter-electrode; (c) an electrolyte disposed between the thin film semiconducting electrode and the counter-electrode; (d) external bias means between the electrode for biasing the electrode with from 0 to about 1 V; and (e) means for collecting hydrogen produced.

**21316** (NSF/RANN/SE/AER—72-03597/A03/74/4) **Photochemical conversion of solar energy. Annual report, January 1, 1974—December 31, 1974.** Lichtin, N.N. (Boston Univ., Mass. (USA). Dept. of Chemistry). 7 Feb 1975. 68p. Univ.

Patent application was made for the thin layer (50 to 300 microns) totally illuminated (TI-TL) photogalvanic cell with semiconductor electrode(s). Quantum efficiencies for current and power conversion of absorbed light of an iron-thionine TL cell with $SnO_2$ and Pt electrodes were, respectively, 64% and 1.5%. A 2.6 x $10^{-2}$% engineering efficiency for power conversion of incident sunlight by the TI-TL iron-thionine cell was observed with illumination normal to the electrodes. This efficiency is approximately $10^3$-fold greater than previously reported values. End-on illumination gave 5.7 x $10^{-2}$% engineering efficiency. Sunlight efficiencies were similar for iron-thionine (λ/sub max/ = 602 nm) and iron-methylene blue (λ/sub max/ = 665 nm); power outputs were additive with both dyes present. Initial work on photoformation of $Br_2$ from aqueous $FeBr_3$, a simple fuel-forming reaction, achieved a 5% quantum yield at 436 nm. A workshop devoted to photochemical formation of fuel was held at Boston University's Osgood Hill Conference Center on September 23 and 24, 1974. Abstracts of papers and summaries of discussions are included.

## SOLAR THERMAL POWER PLANTS

*REFER ALSO TO CITATION(S) 21599, 21670*

**21317 Georgia Tech Solar Thermal Test Facility.** Walton, J.D. Jr.; Bomar, S.H. Jr.; Poulos, N.E.; Brown, C.T. (Georgia Inst. of Tech., Atlanta). pp 38.28 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977). From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Georgia Tech has constructed a 400 KWth Solar Thermal Test Facility (GT/STTF) for high temperature solar energy research and development. The GT/STTF utilizes 550 round mirrors 111 cm in diameter to provide concentrated solar energy to a focal zone located 20 meters above the center of the mirror field. The mirror field is octagonal in shape and the heliostats which guide the mirrors to track the sun are operated by an electrically-driven clock controlled mechanism. The mirrors may be operated flat or focused to provide heat fluxes from 25 to 200 w/cm² to the focal zone. The first use of the facility was to heat a boiler superheater to deliver 365 kg/hr of steam at 150 atmospheres and 600°C.

### CENTRAL RECEIVER

**21318** (SAN/1108—8/2) **Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem.** Hallet, R.W. Jr.; Gervais, R.L. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Oct 1977. Contract EY-76-C-03-1108. 373p. (MDC-G—6776(Vol.3)(Bk.1)). Dep. NTIS, PC A16/MF A01.

The central receiver system consists of a field of heliostats, a central receiver, a thermal storage unit, an electrical power generation system, and balance of plant. This volume discusses the collector field geometry, requirements and configuration. The development of the collector system and subsystems are discussed and the selection rationale outlined. System safety and availability are covered. Finally, the plans for collector portion of the central receiver system are reviewed.

**21319** (SAN/1108—8/3) **Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem.** Hallet, R.W. Jr.; Gervais, R.L. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Oct 1977. Contract EY-76-C-03-1108. 454p. (MDC-G—6776(Vol.3)(Bk.2)). Dep. NTIS, PC A20/MF A01.

The methods and plans for the manufacture of the 10-MW collector heliostats and associated controls for the pilot plant are detailed. An in-depth description of the production, installation, and verification testing of heliostats for the pilot plant is presented. Specifications for the performance, design, and test requirements for the pilot plant collector subsystem are included. Also, a heliostat location summary report is given. (WHK)

**21320** (SAN/1108—8/4) **Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem.** Hallet, R.W. Jr.; Gervais, R.L. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Nov 1977. Contract EY-76-C-03-1108. 393p. (MDC-G—6776(Vol.4)). Dep. NTIS, PC A17/MF A01.

The conception, design, and testing of the receiver subsystem proposed by the McDonnell Douglas/Rocketdyne Receiver team for the DOE 10-MW Pilot Plant and the 100-MW Commercial Plant are described. The receiver subsystem consists of the receiver unit, the tower on which the receiver unit is mounted above the collector field, and the supporting control and instrumentation equipment. The plans for implementation of the Pilot Plant are given including the anticipated schedule and production plan (procurement, installation, checkout, and maintenance). Specifications for the performance, design, and test requirements for the Pilot Plant receiver subsystem are included. (WHK)

**21321** (SAN/1108—8/5) **Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem.** Hallet, R.W. Jr.; Gervais, R.L. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Oct 1977. Contract EY-76-C-03-1108. 544p. (MDC-G—6776(Vol.5)). Dep. NTIS, PC A23/MF A01.

The proposed 100-MWe Commercial Plant Thermal Storage System (TSS) employs sensible heat storage using dual liquid and solid media for the heat storage in each of four tanks, with the thermocline principle applied to provide high-temperature, extractable energy independent of the total energy stored. The 10-MW Pilot Plant employs a similar system except uses only a single tank. The high-temperature organic fluid Caloria HT43 and a rock mixture of river gravel and No. 6 silica sand were selected for heat storage in both systems. The system design, installation, performance testing, safety characteristics, and specifications are described in detail. (WHK)

**21322 Tower-type solar power plant: configuration and thermal-regime stability of receivers and steam generators.** Teplyakov, D.I.; Aparisi, R.R. (Krzhizhanovski State Sci-Res Energy Inst, USSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 31-39(1977).

A graph-analytic method is presented together with results obtained in calculating the irradiances at the generatrices of cylindrical receiver steam generators formed by flat fields of reflectors in tower-type solar power plants of various configurations (axisymmetric and eccentric). The "thermal bias" appearing at the ray-collecting surfaces of the receivers in the course of the working day is demonstrated; it results from changes in geometry and in the amount of direct solar radiation. 9 refs.

### TOTAL ENERGY AND HYBRID SYSTEMS

**21323** (ALO/3987—1/2) **Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design.** (Energy Research and Development Administration, Albuquerque, N.Mex. (USA). Albuquerque Operations Office). 17 Oct 1977. Contract EG-77-C-04-3987. 193p. Dep. NTIS, PC A09/MF A01.

The Stearns-Roger Engineering Company conceptual design of ERDA's Large Scale Experiment No. 2 (LSE No. 2) is presented. The various LSEs are part of ERDA's Solar Total Energy Program (STES) and a separate activity of the National Solar Thermal Power Systems Program. The object of this LSE is to design, construct, test, evaluate and operate a STES for the purpose of obtaining experience with large scale hardware systems and to establish engineering capability for subsequent demonstration projects. This particular LSE is to be located at Shenandoah, Georgia, and will provide power to the Bleyle knitwear factory. The Solar Total Energy system is sized to supply 1.720 MW thermal power and 383.6 KW electrical power. The STES is sized for the extended knitwear plant of 3902 M² (42,000 sq-ft) which will eventually employ 300 people. The details of studies conducted for Phase II of the Solar Total Energy System (STES) for the conceptual design requirements of the facility are presented. Included in this section are the detailed descriptions and analyses of the following subtasks: facility concept design, system concept design, performance analysis, operation plan, component and subsystem development, procurement plan, cost estimating and scheduling, and technical and management plans. (WHK)

**21324** (ALO/3987—1/3) **Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress**

**report. Volume III. Appendix.** (Energy Research and Development Administration, Albuquerque, N.Mex. (USA). Albuquerque Operations Office). 17 Oct 1977. Contract EG-77-C-04-3987. 121p. Dep. NTIS, PC A06/MF A01.

This is the appendix to the Stearns-Roger Engineering Company conceptual design report on ERDA's Large Scale Experiment No. 2 (LSE No. 2). The object of this LSE is to design, construct, test, evaluate and operate a STES for the purpose of obtaining experience with large scale hardware systems and to establish engineering capability for subsequent demonstration projects. This particular LSE is to be located at Shenandoah, Georgia, and will provide power to the Bleyle knitwear factory. Under this contract Stearns-Roger developed a conceptual design, which was site specific, containing the following major elements: System Requirements Analysis, Site Description, System Conceptual Design, Conceptual Test and Operating Plans, Development Plans, Procurement and Management Plans for Subsequent Phases, and Cost Estimates. The Solar Total Energy system is sized to supply 1.720 MW thermal power and 383.6 KW electrical power. The STES is sized for the extended knitwear plant of 3902 $M^2$ (42,000 sq-ft) which will eventually employ 300 people. Drawings, tables, and data sheets are included on hourly temperatures, displacement, utility rates, power conversion system, seasonal design load summary, average collector temperature optimization study, system operating temperature optimization study, power conversion system seasonal performance, thermal storage/fluid loop, system integration, and cost estimates. (WHK)

**21325** (SAN/1132—2/4) **Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report.** (McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)). Apr 1977. Contract EY-76-C-03-1132. 149p. Dep. NTIS, PC A07/MF A01.

First-level designs have been completed for 24 facilities representing 6 major industry groups (SIC Codes 20, 26, 28, 29, 32, and 34), located throughout 6 southwestern states (Arizona, California, Colorado, Oklahoma, New Mexico, and Texas). First-level designs are carried to the depth necessary to establish the thermodynamic balance and identify performance parameters for the major components of the system; namely, collector fields thermal storage, heat exchangers, thermoelectric conversion devices, and major pumps. All of the first-level designs fall into one of the following generically different thermodynamic cycles or combinations thereof: (A) Electricity plus process steam. (B) Electricity plus drying heat (hot air). (C) Electricity plus process steam plus process refrigeration. Summary descriptions of all first-level designs are contained in this appendix. For the reader's convenience, each facility sizing description is meant to stand alone and therefore many of the figures are repeated. The ground rules, assumptions, and definitions associated with the designs are discussed in Volume II of this report.

## OCEAN THERMAL GRADIENT POWER PLANTS

**21326** (DSE/2426—19) **Feasibility study of transporting offshore OTEC-produced energy to shore by thermal media. Project 8980 third topical report, November 1976—July 1977.** Yudow, B.; Konopka, A.; Biederman, N. (Institute of Gas Technology, Chicago, Ill. (USA)). Oct 1977. Contract EX-76-C-01-2426. 112p. Dep. NTIS, PC A06/MF A01.

Thermal-energy media were considered as both methods of storage and of transportation of OTEC-derived energy. Three types of thermal-energy storage media were considered for transport of OTEC energy: (1) sensible-heat media, which depend upon the heat capacity of the material for energy storage; (2) latent heat of fusion materials; and (3) reversible chemical reactions, which depend upon the change in energy content of certain compounds as chemical bonds are broken and other bonds are made. The characteristics of the storage medium, configuration, and materials, the system energy storage density, system thermal losses, heat-engine efficiency, and cycle temperature are specified. The unit capital costs of storage, transport ships, and heat engines are also discussed. The methodology for the economic evaluation of the thermal-energy transport system is also described. A description of the ship transport concept and the economic evaluation methodology and resultant costs for delivered thermal energy and electricity are given. Costs of onshore electricity using OTEC-produced thermal energy (8 cents to 34 cents kW hr) are high. Costs of thermal energy transportation are higher than current process heat costs, but are still comparable. The initial degradation of OTEC-produced shaftpower to heat followed by transmission and reconversion to electricity results in low overall energy transmission efficiencies and high unit energy costs.

**21327** (SAN—235P13-39(Vol.1)) **OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available.** Bretschneider, C.L.; Cherry, J.M.; Pyles, T.K.; Rocheleau, R.E.; Scott, B.B.; Tamaye, E.E. (Hawaii Univ., Honolulu (USA). James K.K. Look Lab. of Oceanographic Engineering). Mar 1977. Contract EY-76-S-03-0235-013. 152p. Dep. NTIS, PC A07/MF A01.

Design of the OTEC Platform to support the Plant—complete with intake pipe and propulsion—and the operation of the Plant to survive and to generate power requires a knowledge of the wind, wave and current components. Identification and evaluation of sources of information on these three components is the major objective of this Task. Operational Sea State (OPSES) and Design Wave Criteria (DEWAC) for the Plant are of chief concern. The wave portion is limited to wind generated waves in deep water; hence, their refraction, reflection, shoaling and breaking are not included. Neither is consideration of tsunami and storm surge. The area of identification and evaluation was deep water offshore USA—except Alaska—and World in 40 degree wide band centered on the Equator as divided into 32 Zones. About one-hundred-sixty sources of information are identified ranging from professional papers, through periodicals, charts and atlases to books especially paper by Hidaka (1959) on wind stress; Hogben and Lumb, a compilation (book) of visual observations of waves; periodicals, booklets and atlases by U.S. Government including: Mariner's Log, a monthly magazine; Summary of Synoptic Meterorological Observations, a number of booklets; Marine Climatic Atlas; Atlas of Sea and Swell; Atlas of Surface Currents; and, Atlas of Pilot Charts. In about 152 8½" x 11" pages these sources are listed and abstracted and divided into "Primary" and "Secondary" references in both OPSES and DEWAC categories for the 32 different Zones and the results evaluated. It is found that there is much better information available in the area offshore USA—alas, excluding Hawaii—and the Arabian-Mid Indian-Bengal Bay-South China Sea area than in the Equator-to-South-20° area where the deficiencies are notable.

## SOLAR RADIATION UTILIZATION

### SPACE HEATING AND COOLING

*REFER ALSO TO CITATION(S) 21272, 21323, 21324, 21746*

**21328** (AED-Conf—1977-053-004) **Possibilities of solar space heating.** Broschk, J. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt. Anwendungstechnik). 21 Mar 1977. 19p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

The assumptions and limitations of solar space heating in the German Federal Republic are examined. The insolation necessary for space heating is calculated. It is concluded that technically the use of solar energy for space heating is technically possible but that in Germany a greater engineering and therefore financial expenditure is necessary because of the unfavorable metorological conditions. Heating needs in spring and fall can be achieved with solar space heating, but conventional systems are necessary for November to February. Therefore for the present the use of direct solar energy for space heating is economically unsound. (JSR)

**21329** (COO/2627—2) **Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877).** (AAI Corp., Baltimore, Md. (USA)). Jun 1977. Contract EY-76-C-02-2627. 176p. NTIS, PC A09/MF A01.

This report covers a two-year and seven-month solar space heating and cooling experiment conducted at the Timonium Elementary School, Timonium, Maryland. The system was designed to provide a minimum of 50% of the energy required during the heating season and to determine the feasibility of using solar energy to power absorption-type chillers for cooling. The area to be heated or cooled totaled approximately 8500 square feet of the center wing of the school. To accomplish this a system containing 5000 square feet of collectors, 5300 square feet of reflectors, a 15,000 gallon insulated hot water storage tank, 40,000 gallons of chilled water storage, an absorption chiller, miscellaneous plumbing, and instrumentation and controls, were installed. The system utilized untreated water (except for one time deionization of initial water supply) as a working fluid. The collection system efficiency (without reflectors) reached a maximum of 56% on a clear day in April 1975. This was with an average water temperature of 161°F. The collection system efficiency (with collector and reflector area totaling 9550 square feet) on a clear day in August amounted to 40.5%. This was with an average water temperature of 170°F. Data on the work accomplished and on the system performance are presented.

**21330** (N—77-26611) **Solar heating and cooling technical data and systems analysis. Progress report, October 1974—30 April 1977.** Christensen, D.L. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). May 1977. Contract NAS8-31293. 152p. (NASA-CR—150305). NTIS PC A08/MF A01.

The research activities described herein were concentrated on the areas of economics, heating and cooling systems, architectural design, materials characteristics, climatic conditions, educational in-

formation packages, and evaluation of solar energy systems and components.

**21331** (NBSIR—77-1314) **Solar energy systems: survey of materials performance. Final report.** Skoda, L.F.; Masters, L.W. (National Bureau of Standards, Washington, D.C. (USA). Inst. for Applied Technology). Oct 1977. Contract EA-77-A-01-6010-051. 113p. Dep. NTIS, PC A06/MF A01.

A study was performed to obtain data on the performance of materials in operational solar energy systems, to identify and assess available standards for evaluating materials, to provide recommendations for the development of test method standards for materials and to provide guidelines to aid the selection of materials for use in solar energy systems. During the study, field inspections of twenty-five operational solar energy systems were performed and a questionnaire was sent to 459 manufacturers and installation contractors to obtain materials performance data. The findings of the study are given here. A primary conclusion is that the process of selecting materials for specific applications within solar energy systems is hindered by the lack of an adequate data base of materials performance under the conditions experienced in solar systems and subsystems. Recommendations are made that would help in establishing an improved data base.

**21332** (NP—22447) **Capturing solar energy in frontages.** (Ecole Polytechnique Federale, Lausanne (Switzerland)). 1977. 33p. (In French). Dep. NTIS (US Sales Only), PC A03/MF A01.

The research program undertaken at the Ecole Polytechnique Federale de Lausanne to determine the possibilities of active and passive solar systems is outlined. The experimental structure built to monitor every half hour under actual climatic conditions the performance of conventional walls and walls provided with solar collectors is described. Precise meteorological data are obtained simultaneously. The performance of a semi-transparent solar collector wall composed of three layers of glass in which the center one is absorbing glass is reported. The programs developed for data analysis are described. Plans for the study of a passive system are outlined. (JSR)

**21333** (UMD—4908-10) **CCMS solar energy pilot study. Solar heating and cooling systems in buildings.** (Maryland Univ., College Park (USA). CCMS Projects Office). 1977. Contract EY-76-S-05-4908. 20p. Dep. NTIS, PC A02/MF A01.

The following are described briefly: significant accomplishments, future events, memorandum of understanding, proceedings of the Copenhagen meeting, special groups, system reporting format, exchange of reports, the CCMS Solar Energy Pilot Study Meeting, and the CCMS Conference on Performance of Solar Heating and Cooling Systems. Included in appendices are: a list of contact persons, a list of central information contacts, preliminary agenda for Mediterranean Applications Group Meeting, preliminary agenda for 1978 Pilot Study Meeting, preliminary agenda for CCMS Technical Conference, and a list of reports exchanged. (MHR)

**21334** **Heat emission of windows, exposed to the Sun.** Snatzke, C. (Inst fuer Bauphys, Holzkirchen, Ger). *Klima Kaelte Ing.;* **5**: No. 7-8, 261-268(1977). (In German).

The heat supply to a room through a window will occur by direct radiant transmission (primary heat supply), whereas the window surfaces are warmed by absorption of the sun rays (secondary heat supply). The ratio of primary and secondary heat supply can be computed if the radiation data and the boundary conditions are known. The paper examines the actual effect of the boundary conditions on the secondary heat supply. This investigation deals for the first time with the influence of the air movement, produced by a window blower, on the internal window surface. 9 refs.

**21335** **Residential solar heating in Uzbekistan.** Aksenov, L.F.; Viron, I.Ya.; Avezov, R.R.; Shvaleva, O.L.; Gafurov, A.M. (Uzb SSR Sci Res Inst for Civ Eng). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 50-52(1977).

The basic arrangement for solar heating, cooling, and hot-water supply in Tashkent buildings is described; the example considered is an experimental 32-apartment building with solar heating and hot-water supply, designed by the Uzbek Scientific Research Institute for Civil Engineering with the participation of the Physicotechnical Institute of the Academy of Sciences of the Uzbek SSR.

**21336** **Typical Mathew Solar House: a three-year report.** Baker, M.S. (Univ. of Oregon, Eugene); Reynolds, J.S.; Larson, M.B. pp 38.2 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Three years of monitoring and investigations of the Mathew Solar House in Coos Bay, OR, are reported. The Mathew House was constructed in 1967 and is one of a handful of solar houses built before the 1973 "energy crisis". The Mathew House is atypical in several respects: its location on the cloudy Oregon coast; its combination of a near-vertical solar collector and near-horizontal reflector; its unusually large storage tank of 8,000 gallons of water storage for 725 $ft^2$ of collector area; and a gravity air circulation system for transporting heat from storage to the heated spaces. The solar house parameters and yearly estimated savings are tabulated. (MHR)

**21337** **Florida residential demonstration.** Hancock, O.G. Jr. (Florida Solar Energy Center, Cape Canaveral). pp 38.3 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The Florida Gas Company is building a solar-powered home in its residential community in Winter Springs, Florida. The system is expected to provide about 90 percent of the cooling requirement and all of the heating and domestic hot water requirements. The system is being installed in cooperation with HUD's Solar Energy Program. The system uses 61.3 $m^2$ of flat plate collectors and 5,110 liters of hot water storage. (MHR)

**21338** **Solar heating of the inaugural stand, 1977.** Bailey, S.C.; Craig, J.L. (Georgia Inst. of Tech., Atlanta). pp 38.4 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The restrictions on the solar heating for the stand are listed. The components used including 10.2 $m^2$ of flat plate solar panels and a 1460 l hot water storage tank are described. Its performance with partial shading, abnormally cold weather, and a brisk wind is discussed. (MHR)

**21339** **First year's operation: residential solar retrofit.** Thomsen, C.L. (Clark Enersen Partners, Lincoln, NE). pp 38.5 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The first year of operation of a solar energy system which was retrofitted to an existing home in Lincoln, Nebraska is described. The air-type system provides space heating and domestic hot water preheating in the winter, and domestic hot water heating during the summer. The storage bin is filled with 10 tons of broken brick. The system provided 44 percent of the heating for the 12-month period. (MHR)

**21340** **Unique solar residence uses conventional construction techniques.** Moore, R. (Moore Construction Co., Las Cruces, NM); Smith, P.R.; Mancini, T.R.; Sabin, R.J.; Connell, H.L. pp 38.6 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Solar residences with floor plan areas ranging from 185.8 $m^2$ to 315.9 $m^2$ have been built in the Las Cruces, New Mexico vicinity using a unique blend of conventional construction techniques and a solar heating system. The construction of the homes is a slab on grade with 50.8 mm x 152.4 mm stud walls faced with brick veneer. The solar heating system is a radiant system. Air moving below an opaque metal collector roof is heated and transferred through a vertical conduit in the center of the house down into a rock storage beneath the slab. The rock storage, with 40 percent voids, is 0.457 m thick and underlies the entire slab of the house, including the garage area. Air is returned to the collector roof by moving up all exterior walls between the brick veneer and the sheeted 50.8 mm x 152.4 mm studs, thus further insulating these walls from the ambient conditions. A small gas furnace, approximately one third the capacity conventionally installed in houses of these sizes, is used as a backup system. The system is operated in reverse during the summer time.

**21341** **Preliminary performance data on a solar heated house (Model 24-31-B SH).** Meyers, A.C. III. (Inst. of Basic and Applied Research, Inc., Arvada, CO). pp 38.7 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Preliminary performance data, including design and construction, of a recently completed house in Denver, Colorado is reported. The 630 ft² of air heating collectors are on the south side of the roof set at the optimum angle for January heating. The south windows are designed, by the use of movable insulated drapes, to enhance the solar heating during daylight hours. The energy available from the collector array is shown by month. (MHR)

**21342 Cortade Library: system performance of first vertical wall passive solar collector array in Orange, Virginia (private library retrofit).** Gottschalk, W.L. (The Rosemary, Orange, VA). pp 38.8 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A single story detached library building (5.5 x 5.5 m) is insulated to R-19 ceiling and R-11 walls and has a concrete slab floor with vapor barrier. The south facing exterior wall of corrugated steel was painted flat black as an absorber plate for the retrofit of a vertical wall passive collector array for space heating the interior space. Glazing is mounted to a wood frame sealed over the absorber plate and fenestrae are provided top and bottom allowing thermally driven circulation of the heated air. The thermal history of the system for January, 1977 is tabulated and cost and savings are discussed. (MHR)

**21343 System performance of first commercial solar installation in Orange, Virginia (retrofitted office building).** Gottschalk, W.L. (The Rosemary, Orange, VA). pp 38.9 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The 51 m² air cooled collector conventional design was field assembled onto the existing gambrel roof. The ratio of floor to collector area is 4 : 1. The existing flat section of the roof to the south of the gambrel serves as a reflector to augment collector performance when it is covered with snow or water. Heat storage is in the thermal mass of the masonry building itself, primarily in the floor slab heated by hot air ducts buried within. (MHR)

**21344 Kuwait solar heated and cooled home.** Debs, A.S. (Georgia Inst. of Tech., Atlanta); Williams, J.R.; Hudson, W.T.; Malik, M.A. pp 38.10 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A solar cooling, heating, and hot water utilization system installed in a mobile home unit at the Kuwait Institute for Scientific Research is described. A 2000-gallon thermal storage tank is provided. Because of the special climate conditions of Kuwait, two alternative heat rejection mechanisms for condensing were provided for comparative performance analysis. (MHR)

**21345 Installation and testing of a solar heating system for an aquatic recreational facility.** Hudson, W.T. (Independent Living, Inc., Atlanta); Corsini, H.A.; Williams, J.R. pp 38.11 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A solar heating and domestic hot water system has been installed for a recreational facility in Macon, Georgia to provide space heating, hot water, and swimming pool heating. The collector array incorporates 36 Revere copper modular collectors, each 18.5 sq. ft. in area, single glazed with double-weight tempered glass. Two 1,000 gallon steel storage tanks are used for thermal storage. The performance of the solar system was calculated using the computer programs, one utilizing average solar radiation data and the other an hour by hour system performance simulation. (MHR)

**21346 Design and installation of the HUD solar home in Shenandoah, Georgia.** Williams, J.R. (Georgia Inst. of Tech., Atlanta); Hudson, W.T. pp 38.12 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The 1,400 sq. ft. solar home (plus full basement) utilizes a 273 sq. ft. double glazed copper flat plate collector array integrated into the south facing roof of the home. The collectors utilize copper laminated plywood as the absorbing surface to which copper rectangular tubes are clamped and bonded, and the copper surface is coated with 3-M's Nextel Black Velvet paint. The 1,000 gallon steel thermal storage tank located in the basement is surrounded by over a foot of blown-in fiberglass insulation. The tank sits upon a 2 inch slab of foam glass over 2 inches of styrofoam. The collectors drain naturally whenever the pump is off so there are no problems with freezing in the collector even though no antifreeze is used in the system. The solar energy system utilizes a 2-ton water source heat pump to provide back-up heating in either the solar assist or conventional mode, and summer air conditioning. (MHR)

**21347 Design, installation and testing of the HUD solar home in Dacula, Georgia.** Lindsay, W. (Winford Lindsay and Associates, Lawrenceville, GA); Hudson, W.T.; Williams, J.R. pp 38.13 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 25—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A new solar home has been completed in Dacula, Georgia, using a commercially available packaged solar hydronic space heating and hot water system. The system utilizes 234 sq. ft. of double glazed copper integrated roof solar collectors to provide space heating and domestic hot water for the 1,000 sq. ft. home. The collectors are of Revere Integrated Roof new construction panels with rectangular copper tubing clamped and bonded to copper laminated plywood covered by double-glazed sealed insulated glass sandwiches supported on copper battens. The absorbing surface is of 3-M's Nextel Black Velvet paint. The 500 gallon thermal storage tank is constructed of steel with all seams double welded, inside and out. It is 6 feet in diameter and 3 feet high buried in the ground at the end of the house. (MHR)

**21348 Design and installation of hydronic solar systems for three cycle-two HUD housing units in Georgia.** McCloud, W.T. II (Fairview Builders, Inc., Tucker, GA); Hudson, W.T.; Lindsay, W.; Williams, J.R. pp 38.14 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Three solar homes have been constructed under a HUD grant at the same site north of Atlanta using identical solar energy systems. The installation of identical solar systems in three homes of different architectural design is providing an opportunity to evaluate the effect of architectural considerations on solar system performance. Each system incorporates 234 sq. ft. of Revere Integrated Roof solar collectors, a 1,000 gallon coal tar epoxy coated steel thermal storage tank, and an 80 gallon domestic hot water tank. The collectors are single glazed at an angle of 45°. These homes incorporate numerous energy conservation features including flow control devices to reduce hot water consumption, fluorescent lights, extra insulation and a clock thermostat. The design heating load is 17,000 BTU/hr. about half that of a typical house of the same size. A solar equipment room added to the gable end of the houses conserves costly interior space.

**21349 Installation of a commercially-available pre-packaged hydronic solar heating system by a homeowner.** Reihl, J.D.; Hudson, W.T.; Williams, J.R. pp 38.15 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A commercially-available pre-packaged solar heating and hot water system has been homeowner installed in a home in Alpharetta, Georgia. The system utilizes 400 sq. ft. of Revere Integrated Roof collectors, which consist of copper laminated plywood to which rectangular copper tubes are clamped and bonded, coated with 3-M'ms Nextel Black Velvet paint and covered with Kalwall glazing. The system utilizes two 1,000 gallon concrete storage tanks buried under the garage and provides two separate heating zones. The total design heat load for the house is 61,000 BTU/hr, for a UA factor of 1,115 BTU/hr per sq. ft. The only backup is a wood burning fireplace.

**21350 Installation and operation of solar heating system for the Hooker Barnes solar home.** Hudson, W.T. (Independent Living, Inc., Atlanta); Williams, J.R. pp 38.16 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977).

See CONF-770603—P3.

The Hooker Barnes solar home illustrates how a conventional home of standard construction can be adopted to solar energy by mounting modular collectors on the roof with the thermal storage tanks located in the basement. This house was one of the first HUD projects to be completed in the United States.

**21351 Solar heating and cooling system demonstration for the School of Mechanical Engineering at Georgia Tech.** Leonaitis, L.L.; Jeter, S.M.; Williams, J.R. (Georgia Inst. of Tech., Atlanta). pp 38.17 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

An array of forty-eight flat plate solar collectors are in use for a demonstration project to provide hot water space heating and chilled water space cooling for a portion of a building at the School of Mechanical Engineering at Georgia Tech, Atlanta, Georgia (33.8°N, 84.4° W). The solar collectors comprise a south facing array of the two rows containing twenty-four modular collectors per row for a total aperture of 78.97 $m^2$ (850 $ft^2$). The piping, insulation, heat storage, air handlers and other equipment are described.

**21352 Design of a solar heated energy conservation house for western Canada.** Besant, R.W. (Univ. of Saskatchewan, Saskatoon, Can.); Schoenau, G.J.; Dumont, R.S.; Eyre, D. pp 38.18 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The thermal design of an energy conservation and solar heated house is described which will be self-sufficient in thermal energy other than for electrical appliances and motors. The house, which is sponsored by the Province of Saskatchewan, will be constructed in Regina, Saskatchewan during the summer of 1977. The house will feature a number of energy conservation measures such as insulation well above average in the walls, ceiling and floor, mobile insulation in the windows and heat recovery from controlled ventilation air flow and service hot water. The solar collectors and storage system was sized to be cost effective for seasonal storage, albeit, the solar system is not justified compared to electrical heating at this time. The special low cost, high performance air to air heat exchanger provides fresh air to control humidity and household odors. Heat recovery from domestic hot water is a feature which can be used 12 months of the year. The windows are designed to provide, on average, all of the space heating requirements as well as light during the day by passive solar gains. The house has a total annual heating load of only about $^1/_{10}$ of that required by the average 1975 house of the same size. The remaining thermal energy load is to be provided by 15.3 $m^2$ (164 $ft^2$) of active vacuum tube solar collector on a 70 degree slope at an azimuthal angle of 10 degrees west of south. The 16.3 $m^3$ water storage tank is located inside the house.

**21353 Terraset: taking less from the Earth.** Hlavin, A.C.; Martin, A.A. (Fairfax County School Board, VA). pp 38.19 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

An underground school is described. The mechanical system is an all electric solar-assisted heat pump/heat reclaim heating and cooling hydronic system. The solar collectors are evacuated tubular glass with reflector and an effective surface area of 448 $m^2$. Solar cooling is provided by absorption chillers. (MHR)

**21354 Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida.** Rainer, G.; Hadden, R.M. (Flack and Kurtz, New York). pp 38.20 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The feasibility of using solar collection technology for the proposed Naval Regional Medical Center in Orlando, Florida was evaluated. The weather conditions for Orlando, as they affect optimum mechanical system selection, are graphed and analyzed. The building energy requirements, including comfort heating, cooling and domestic hot water, were calculated by means of a computerized energy analysis program for every hour of a typical year in Orlando. Performance of state-of-the-art collectors was graphed, and preferred application for specific end uses was identified. Collector performance over a typical year was simulated using the Ross Meriwether energy analysis program. A typical curve is shown. Building energy requirements were then matched by simulation against collector capabilities combined with varying heat storage volumes, to determine optimum system configuration. A preliminary design integrating the solar collection systems into the basic building mechanical systems was prepared. Finally an economic cost/benefit analysis was made.

**21355 Analysis of a solar powered residential cooling and heating system.** Mei, H.; Calvin, K.; Tansamrit, S. (Lamar Univ., Beaumont, TX). pp 38.21 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A solar heating and cooling system was designed for a 478$m^2$ (5146 sq. ft.) single family residential dwelling near Beaumont, Texas. The primary components of this system include: 93$m^2$ (1000 $ft.^2$) solar collector, one 5678 l (1500 gal.) hot water storage tank, auxiliary boiler, chiller (Atkla Unit), and domestic hot water heat exchanger. The solar system is expected to provide 95% of annual heating requirement, 95% of annual domestic water heating and 70% of annual cooling requirement for the home.

**21356 Improving the performance of a solar energy heating system.** Eden, A.; Tinsley, J.T. (Air Force Academy, CO). pp 38.22 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The continuing performance of the first retrofit-constructed solar-heated facility in the United States Air Force, the Solar Test House at the United States Air Force Academy, Colorado Springs, Colorado is described. A typical single family dwelling was selected for this research due to the large number of these structures on Air Force Bases. Two arrays of flat plate collectors of copper sheet and tube type constuction with two layers of glass covers were used for this project; one on the roof and one on the ground. The solar energy system has been in operation since December 1975.

**21357 Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project).** Othmer, P.; Scott, J. (California State Univ., Fullerton). pp 38.24 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The preliminary thermal design and transient simulation studies for retrofitting a school for both solar heating and cooling are described. The solar hardware to be installed consists primarily of high temperature solar collectors and associated pumps, plumbing and controls to interface with the existing boiler fired hot water loop. To operate the existing water fired arkla absorption chillers, high temperature water in the range of 180°F to 210°F was required. The final design of the systems uses 5000 $ft.^2$ of evacuated glass tube solar collectors for the 40,000 $ft.^2$ building. A computer analysis of the system is described. (MHR)

**21358 Integrating solar heating and off peak electricity usage.** Koenigshofer, D.R. (Integrated Energy System, Chapel Hill, NC). pp 38.25 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 25—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Solar heating systems were designed using off-peak electricity to have the storage tank at certain minimum temperature every morning. One problem is the decrement in performance of flat plate collectors as the temperature of the incoming water increases. Various solutions to the problem of the high operating temperature of the fan-coil are mentioned. (MHR)

**21359 Integrated 100% solar heated and cooled house using multi-stage air collectors.** Levine, R.S. (Univ. of Kentucky, Lexington). pp 38.30 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The active collectors are long multi-stage air collectors that are integrated into the fabric of the building. In place they provide

roofing, structure, and insulation for the whole south roof/wall. Heat storage is by a three-stage cascading rock bin system that can operate in combination of sequential or bypass modes. Windows with insulated shutters are passive collectors. The windows are of 3 types; light windows, see-through windows, and ventilation windows. (MHR)

### AGRICULTURAL AND INDUSTRIAL PROCESS HEAT

*REFER ALSO TO CITATION(S) 21323, 21324, 21325*

**21360** (SAN/1220—1) **Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10.** (General Electric Co., Philadelphia, Pa. (USA). Space Div.). Sep 1977. Contract EY-76-C-03-1220. 265p. Dep. NTIS, PC A12/MF A01.

The design plan for a solar process hot water system for a textile dye beck at Riegel Textile Corporation's LaFrance, South Carolina, facilities is presented. The solar system consists of 396 GE model TC 100 evacuated tube collector modules arranged in a ground mounted array with a total collector area of 6680 square feet. The system includes an 8000-gallon hot water storage tank. Systems analyses, specification sheets, performance data, and an economic evaluation of the proposed system are presented. (WHK)

**21361 Solar powered anaerobic wastewater treatment plant.** Wilke, D.A.; Fuller, D. pp 38.1 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The design of the Wilton, Maine, municipal waste water treatment plant is described briefly. The enclosing structures are oriented southward to achieve maximum value from the sun's direct energy through both passive and hydronic solar energy collection devices. The use of solar energy to heat the digesters, frees the methane gas to be stored for use in heating the building and running the electric generator, thus overcoming the problems of solar energy-storage. (MHR)

**21362 Solar energy: soybean drying facility (Jan 1977) (Engineering Materials).** (Teledyne Brown Engineering, Huntsville, Ala. (USA)). (CAPE—2607).

55 drawings.

Drawings are given for a soybean solar drying facility, including electronic instrumentation and temperature controls. Construction drawings include the solar panel attachment, site preparation plan, support structure, foundations, air transport system, power system, and electrical controls. (PMA)

### WATER HEATING

*REFER ALSO TO CITATION(S) 21335, 21337, 21344, 21345, 21347, 21348, 21349, 21350, 21354, 21355*

**21363 Development and testing of solar water-heated boilers fabricated by diffusion welding.** Umarov, G.Ya.; Soatov, F.; Avezov, R.R.; Sigalov, Yu.M.; Koryagin, N.I. (Acad of Sci of the Uzb SSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 48-49(1977).

Fabrication technology and test results are described for solar water-heater boilers fabricated of type AD-1 alloy by diffusion welding. They are shown to be reliable in operation and to have good thermal and anticorrosion properties.

**21364 Appropriate plumbing for open solar water heaters.** Chandra, S.; Hancock, O. (Florida Solar Energy Center, Cape Canaveral). pp 38.23 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

Of the solar domestic water heaters installed today in warm Florida, most systems are of the "open" type where potable water circulates through the collector. In such systems, it is best to have one single storage tank of adequate capacity. It may be desirable to adapt the existing electric water heater and connect the solar system to it. One proper way of plumbing the system is shown.

**21365 Further development of the reinforced pillow solar water heater.** Harris, W.B.; Davison, R.R. (Texas A and M Univ., College Station). pp 38.26 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The reinforced pillow solar heater of water confining materials such as butyl rubber of Hypalon/super R/ which are durable, corrosion resistant, and freeze resistant is described. The bag has heat sealed channels and is fastened between wire mesh and plywood with screws or roofing nails. The bag may be used alone for a swimming pool heater or backed by insulation and glazed. (MHR)

### OTHER

*REFER ALSO TO CITATION(S) 21260*

**21366 Investigation of solar absorption cooler for round-the-clock operation.** Vakhidov, A.T.; Maksudov, T.M. (Samarkand Coop Inst, Uzb SSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 45-47(1977).

The solar coolers that have so far become familiar do not operate for more than 5-6 hr per day. The article describes the design of solar coolers for round-the-clock operation. They involve condensation and absorption spray cooling for use under stepped conditions. Thus in the chambers of such coolers the 24-h temperature fluctuates between 263-288°K, so that long-term storage of rapidly spoiling products is not possible. The working fluid is a water-ammonia solution that offers several advantages over other working solutions owing to its thermophysical and thermodynamic properties. In particular, by varying the concentration it is possible to regulate the boiling point of this solution and thus ensure cooler operation at reduced solar-radiation densities during the spring and fall. This permits "hot-box" type heat receivers to be used with adequate efficiency.

## SOLAR COLLECTORS AND CONCENTRATORS

*REFER ALSO TO CITATION(S) 21270, 21272, 21295, 21318, 21319, 21320, 21322, 21331, 21332*

**21367** (COO/2608—1) **Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975—August 31, 1975.** Ortabasi, U.; Fehlner, F.P. (Corning Glass Works, N.Y. (USA)). 1975. Contract EY-76-C-02-2608. 192p. Dep. NTIS, PC A09/MF A01.

Research and development activities performed by the Corning Glass Works solar group during the period from May 1, 1975 to August 31, 1975 are reported. The analytical studies encompassed optical modeling of a modified cusp reflector, fresnel losses from tubular enclosures as a function of orientation, preliminary work on a digital Monte-Carlo Ray Tracing Computer Code and the determination of U/sub L/ losses as a function of vacuum level and temperature of the absorber. Compatible enclosure materials, wicks and working fluids were selected to assemble heat pipes for use as solar collector absorbers. Cusp reflectors with good accuracy were fabricated from various commercial bright aluminum sheet and their optical properties determined. Evacuation techniques were developed and special bake-out procedures were worked out to assemble the evacuated tubular collectors. The work on selective coatings narrowed down the field of potential absorber films to "black chrome" which has good stability in vacuum and the necessary $\alpha$/epsilon value. Six different heat pipes and one flow-through absorber were fabricated and were partially characterized for thermal performance. Indoor and outdoor test facilities were completed and calibrated within proposed NBS standards. They are now available for parametric as well as true-life experiments with solar radiation.

**21368 Cover for solar energy collectors.** Justi, E.; Fitz, H.; Schmoelling, K. (to to Messer Griesheim G.m.b.H.). German(FRG) Patent 2,502,595/A/. 5 Aug 1976. 8p. (In German).

Plastic covers for solar collectors exhibiting a transmission in excess of 90% for visible radiation, and an absorption in excess of 90% for infrared (particularily the 7-10 $\mu$m of maximum collector emission) are manufactured with fluorine plastics. Particularily suited are derivatives of polyvinylfluoride or mixed polymers of ethylene and chlorinetrifluorethylene, or of ethylene and tetrafluorethylene. Fibres may be incorporated to improve rigidity. These covers exhibit good mechanical properties, are cheap, and easy to clean.

**21369** (N—77-26610) **Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report.** Robertson, J.E. (Wyle Labs., Huntsville, Ala. (USA)). May 1977. Contract NAS8-31662. 72p. (NASA-CR—150300; TM—77-5). NTIS PC A04/MF A01.

A project was initiated to establish a technical data base on line focusing acrylic Fresnel lenses for use in a solar collector system that could generate temperatures in the range of 200 C to 370 C. The effort was originally directed toward electric power generation in the 100 to 10,000 kWe range using a distributed collector approach. However, as the program progressed, it centered on the development of a concentrator/collector subsystem concept that could meet the general requirement of thermal delivery within the 200 C to 370

C range. The expanded list of possible applications includes commercial heating/cooling and industrial process heat as well as electric power generation.

**21370** (N—77-26617) **Evaluation of initial collector field performance at the Langley Solar Building Test Facility.** Boyle, R.J.; Jensen, R.N.; Knoll, R.H. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). Jun 1977. 22p. (NASA-TM-X—73677). NTIS PC A02/MF A01.

The thermal performance of the solar collector field for the NASA Langley Solar Building Test Facility is given for October 1976 through January 1977. A 1,180 square meter solar collector field with seven collector designs helped to provide hot water for the building heating system and absorption air conditioner. The collectors were arranged in 12 rows with nominally 51 collectors per row. Heat transfer rates for each row were calculated and recorded along with sensor, insolation, and weather data every five minutes using a minicomputer. The agreement between the experimental and predicted collector efficiencies was generally within five percentage points.

**21371** **Selective absorption properties of lead sulfide—aluminum coatings as a function of lead sulfide thickness.** Marchini, R.; Gandy, R. (Physics Department, Memphis State University, Memphis, Tennessee 38152). *J. Appl. Phys.;* **49**: No. 1, 390-391(Jan 1978).

The dependence of the absorptivity and emissivity of lead sulfide films on thickness was investigated. Theoretical calculations were made using the bulk—lead sulfide model. Reflectance measurements in the visible and infrared regions of the spectrum were made to determine absorptivity and emissivity values. Both the theoretical and experimental results predict optimum a/e values for the lead sulfide thickness range 300—800 A.

**21372** **Concentration of diffuse radiation.** Baranov, V.K. *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 21-25(1977).

When a parabolotoroidal focon or parabolocylindrical focline is used to concentrate solar energy, the sun's disk occupies a negligible fraction of the field of view. The field of view is basically covered by the sections of sky and clouds surrounding the star, which scatter solar radiation. Results are reported for investigations that make it possible to determine the fundamental laws of focon and focline operation in concentrating the radiation of extended sources. Analytic relationships are given that make it possible to determine the average flux density in the minor aperture of a focon of focline as a function of the flux density set up in the plane of the major aperture by objects that fall into the field of view of such concentrators. Focons and lens systems are compared in terms of their ability to concentrate the radiation of extended sources. It is shown that when a focon is used to concentrate the diffuse radiation of extended sources it is in many cases possible to increase the density of the concentrated flux.

**21373** **Investigating the geometric quality of cast polyurethane-foam duplicates for solar-energy concentrators.** Bazarov, B.A.; Kapelyushnikov, V.M.; Kalinin, B.A. (Acad of Sci of Physicotech Inst, Turkm SSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 17-20(1977).

An experimental method is considered that makes it possible to investigate the quality of solar concentrators based on rigid polyurethane foams. Fundamental computational relationships are given for evaluating the correspondence of a geometric shape of the fabricated duplicates to the die, the reference.

**21374** **Analyzing multifacet concentrating systems.** Zakhidov, R.A.; Khodzhaev, A.Sh. (Acad Nauk, Uzb SSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 26-30(1977).

Various methods of designing multifaceted concentrating systems are analyzed. The distribution of irradiance in the focal volume of long-focus mirrors (facets) is investigated. It is shown that for the general case, the plane in which maximum irradiance is reached does not coincide with the focal plane of the mirror. The position of the maximum-irradiance plane depends on the relationship between the angular dimensions of the mirror and the radiation source (the sun). A method is proposed for calculating the focal parameters of facets as a function of the position on the supporting base and the function of the multifacet concentrating system. 17 refs.

**21375** **Compound trapezoidal collector (an optimized stationary concentrator).** Villanueva, J.; Truong, H.V. (Florida Atlantic Univ., Boca Raton). pp 36.25-36.29 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).
From Solar world meeting; Orlando, FL, USA (6 Jun 1977).
See CONF-770603—P3.

The design, evaluation, and optimization of a non-tracking compound trapezoidal groove collector (CTC) are presented. The proposed collector is compared to the Winston compound parabolic collector (CPC) and to the single trapezoidal groove collector. The proposed collector geometry consists of two successive trapezoidal grooves, the relative dimensions of which are optimized to accept (with no more than one reflection) all the solar energy impinging upon it when the sun's rays are directed along the optical axis of the collector. Computer simulation of the proposed collector shows that instantaneous concentration ratios as high as 5 (five) can be achieved with this geometry, while time averaged concentrations of about 3.5 (during a complete collecting period of eight hours) are possible. The angular acceptance of this collector is quite reasonable and compares favorably with the truncated compound parabolic collector proposed by Winston and with trapezoidal groove collectors.

**21376** **Internal cusp reflector for an evacuated tubular heat pipe solar thermal collector.** Ortabasi, U.; Buehl, W.M. (Corning Glass Works, NY). pp 36.30-36.36 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).
From Solar world meeting; Orlando, FL, USA (6 Jun 1977).
See CONF-770603—P3.

This study involves the optical analysis of a slightly concentrating, symmetric cusp reflector inside a tubular glass envelope with a cylindrical heat pipe as the solar absorber. The basic design features of this nontracking, evacuated, modular collector and the principles of heat removal are shown. Differential equations of the cusp reflector optics, given the geometrical restrictions, are derived, and solutions for the largest possible aperture inside a given diameter envelope and acceptance angle are presented. As an extension of the same study, the optical efficiency of a single collector tube has been simulated by means of a Monte-Carlo Ray-Tracing Program. For a concentration ratio of 1.15, the flux distribution around the heat pipe is computed as a function of incidence angle. In addition, the impact of mirror defects and absorber misalignment on the optical performance are analyzed.

**21377** **Design of flat reflector—collector combinations.** Downey, W.T.; Converse, A.O. (Dartmouth College, Hanover, NH). pp 37.1-37.5 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).
From Solar world meeting; Orlando, FL, USA (6 Jun 1977).
See CONF-770603—P3.

The desirability of adding a flat reflector to a flat plate solar water heating system has been studied through computer simulation. It is found that the reflector is slightly cost effective in the North (Hanover, N.H.), but not in the South (Savannah, Ga.).

**21378** **Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results.** Grimmer, D.P. (Los Alamos Scientific Lab., NM); Zinn, K.G.; Herr, K.C.; Wood, B.E. pp 37.6-37.11 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).
From Solar world meeting; Orlando, FL, USA (6 Jun 1977).
See CONF-770603—P3.

The use of planar reflective surfaces can substantially improve the performance of both active and passive solar collectors. The results of theoretical calculations and experimental tests are presented on the use of different types of flat reflective surfaces to increase the collection of solar energy by flat collectors. Specular, diffuse, and combination specular/diffuse reflective surfaces are discussed. Here an attempt has been made to describe the reflective properties of surfaces in more generalized terms than simple direct or simple diffuse. Most real surfaces possess a combination of specular- and diffuse-like reflectivities. The reflectivity properties of a given surface can be measured in the laboratory as a function of incident and reflected angles, and these measured reflective properties can be used in the computer model to predict the increase in collector performance with such a reflector. Thus outdoor tests of a given reflector can be avoided if desired, and yet it is possible to make an estimate of the reflector's contribution to the collector's overall performance. Theoretical calculations of collector energy inputs were done for several distinct types of reflecting surfaces. These calculations based on indoor laboratory measurements of the reflective properties of the surfaces, were compared with experimental results obtained from an outdoor simulation apparatus. Predictions of system performance were made for various collector/reflector configurations, and compared with the performance of an optimally oriented collector without a reflector.

**21379** **Measurements on the effect of planar reflectors on the flux received by flat-plate collectors.** Reid, R.L.; Chilcoat, M.; Yuko, M.J. (Cleveland State Univ.). pp 37.12-37.15 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; For-

dyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The effect of planar reflectors on the flux received by flat plate collectors was determined both through experiments and an analytical model. The particular application studied was an inverted V-roof solar house configuration. Experimental data were taken for mirror Plexiglas and aluminum. These results were compared with the analytical model written for specular reflection. Results from the model were generated for flux received both with and without the reflector for a yearly period.

**21380 Enhancement of flat plate solar collector performance through the use of planar reflectors.** Hill, J.M.; Perry, E.H. (Memphis State Univ.). pp 37.16-37.19 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A study was undertaken to determine insolation and collector performance enhancement factors resulting from the presence of specular planar reflectors in front of flat-plate solar energy collectors. Both a mathematical analysis of the problem and experimental measurements of the enhancement factors were involved. Among the variables included in the analysis are the collector and reflector tilt angles, the reflector-to-collector height ratio, and the collector aspect ratio. It was shown that such reflectors can significantly improve the performance of flat-plate solar collector arrays.

**21381 Analytical and experimental study of total internal reflection prismatic panels for solar energy concentrators.** O'Neill, M.J.; Gupta, Y.P. (E-Systems, Inc., Dallas). pp 37.20-37.24 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

E-Systems has pursued the analysis, design, development and testing of prismatic panels which utilize total internal reflection (TIR) to accomplish the concentration of solar energy. Such panels offer the potential of better performance at lower cost for numerous solar concentrator applications, including heliostats for Central Receiver (Power Tower) electric power plants and various parabolic concentrators. A description of the new reflector concept, and results of preliminary theoretical and empirical studies of its performance are presented.

**21382 Solar collector cost reduction with reflector enhancement.** Clausing, A.M.; Edgecombe, A.L. (Univ. of Illinois, Urbana). pp 37.25-37.29 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The use of fixed specular reflectors in combination with conventional flat plate solar collectors is studied. The objective is to reduce the high capital cost of solar collector systems through the use of inexpensive specular reflectors. The study was precipitated by the use of solar energy for grain drying. The seasonal use of the collector system in this application necessitates an inexpensive system in order to be cost effective. A mathematical formulation of a general reflector-collector system is given which encompasses a wide range of geometries and is applicable to any sun position. Two key parameters are introduced, the reflector effectiveness and the reflector efficiency, which provide a meaningful and simple means of evaluating the performance and cost effectiveness of reflector-collector systems. Instantaneous and time-averaged performance data are given for reflector enhanced collector systems, and comparisons are provided with conventional collector systems which clearly show the benefits of the reflector enhancement.

**21383 Concentrating heliostat array for industrial applications.** Moore, W.T.; Kretschek, R.O. (Veda Inc., Camarillo, CA). pp 38.29 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

A new design for a heliostat array proposes a fixed structure carrying many steerable reflector elements, each of which is equatorially mounted. The equatorial mount simplifies the time position equation. The structural arrangement permits predictive control of heliostat elements individually or in combination to selectively provide desired total energy levels and flux distributions over the entry aperture of any of many central receivers.

## HEAT STORAGE

*REFER ALSO TO CITATION(S) 21312, 21321, 21326, 21331*

**21384** (SAND—77-8264) **Analysis of thermally degraded sensible heat storage hydrocarbons.** Burolla, V.P. (Sandia Labs., Livermore, Calif. (USA)). Dec 1977. Contract EY-76-C-04-0789. 28p. Dep. NTIS, PC A03/MF A01.

Heat treated samples of three candidate fluids for sensible heat storage were analyzed using gel-permeation chromatography and infrared spectrophotometry. Comparison of this data with previous work reveals that: The oil is undergoing large-scale thermal cracking that is probably catalyzed by the presence of degradation products. The oil is possibly experiencing some amount of dehydrogenation. There is a very small amount of bulk polymerization taking place. There is little reason to suspect that the oils suffered any significant amount of oxidation. The approximate molecular weight range of fresh Caloria HT 43 is from 170 to 550. Sufficient information is now available to enable design of a processor (fractional distillation column) to ostensibly prolong the usable lifetime of the oil. Based upon the results of a fairly simplistic test, mechanical shear degradation due to pumping and fluid flow in general should not contribute significantly to fluid decomposition.

# GEOTHERMAL ENERGY

**21385** (CONF-761219—(Absts.)) **XII International Congress of Hydrothermal Techniques. Abstracts of papers presented.** (Instituto Nacional de Ciencia y Tecnica Hidricas, Buenos Aires (Argentina)). 1976. 52p. (In several languages). (CONF-761243—(Absts.)). Dep. NTIS (US Sales Only), PC A04/MF A01.

From 12. international congress of hydrothermal techniques; Buenos Aires, Argentina (12 Dec 1976).

Twenty-nine abstracts of papers presented are given in three languages: English, French, and Spanish. (MHR)

**21386 Comprehensive studies on new energy development.** (Agency of Natural Resources and Energy, Tokyo). *Kogyo Gijutsu;* **18**: No. 9, 58-65(1977). (In Japanese).

A comprehensive study program related to the Sunshine Project is responsible for support studies and the identification of previously untapped or overlooked energy sources. Total energy systems are analyzed for social and economic, as well as environmental impact. Relationships between the programs of the Sunshine Project and those of other agencies are examined in order to expedite the appropriate technology transfer between research and development programs. With respect to geothermal energy, all conceivable impacts were carefully scrutinized. Previously untapped energy sources identified for further study include ocean thermal energy, high-temperature electrolytic hydrogen conversion, tar sands and oil shales, and flywheel energy storage, which are briefly discussed and illustrated.

**21387 Geothermal energy technology.** (Agency of Natural Resources and Energy, Tokyo). *Kogyo Gijutsu;* **18**: No. 9, 30-38(1977). (In Japanese).

Geothermal energy research and development by the Sunshine Project is subdivided into five major categories: exploration and exploitation technology, hot-water power generation technology, volcanic power generation technology, environmental conservation and multi-use technology, and equipment materials research. The programs are being carried out by various National Research Institutes, universities, and private industry. During 1976 and 1977, studies were made of the extent of resources, reservoir structure, ground water movement, and neotectonics at the Onikobe and Hachimantai geothermal fields. Studies to be performed in the near future include the use of new prospecting methods, including artificial magnetotellurics, heat balance calculation, brightspot techniques, and remote sensing, as well as laboratory studies of the physical, mechanical, and chemical properties of rock. Studies are continuing in the areas of ore formation in geothermal environments, hot-dry-rock drilling and fracturing, large scale prospecting technology, high temperature-pressure drilling muds and well cements, and arsenic removal techniques.

**21388 Outline of the Sunshine Project.** *Kogyo Gijutsu;* **18**: No. 9, 18-21(1977). (In Japanese).

The Sunshine Project was established by the Japanese government for the purpose of examining energy sources which had been overlooked during the petroleum age. These include solar and

geothermal energy, coal, and hydrogen. The Project is now in its fourth year, and research and development goals are being met on schedule. Two of the basic programs have graduated to the construction stage: a binary solar air-conditioning and water heating system for private residences, and a 1.0 MW geothermal power plant (binary), scheduled to go into operation in 1977. In addition, five pilot projects including a 1.0 MW solar power plant, a coal gasification plant, a coal liquefaction plant, an electrolytic hydrogen manufacturing facility, and a second solar air-conditioning and hot water system are either in the advanced design stage or scheduled for construction.

**21389 Status of ERDA geothermal program and recent developments.** Toms, R.S.H. (Energy Research and Development Administration, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 9(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21390 Geothermal energy. Volume 1. Search period covered: 1970—1974. Citations from the Engineering Index Data Base.** Smith, M.F. (ed.). Springfield, VA; National Technical Information Service (1976). 251p. (NTIS/PS—76/0464).

Studies of worldwide research on geothermal prospecting, regions and resources are cited. Electric power generation, steam heating, and heat recovery are also included along with government policies, assessment, development, and economics.

## RESOURCE STATUS AND ASSESSMENT

**21391 Geothermal power emerging as an alternate energy source.** Austin, W. H. Jr. *Can. Min. J.;* **98**: No. 10, 30-36(Oct 1977).

Recent court decisions on both the State and Federal level in the USA have indicated that geothermal energy is to be considered a mineral resource rather than a water resource. The decisions were based on the fact that the commodity sought is heat, not the transfer medium. This should remove at least one barrier to development. Geothermal resource development was pioneered in Italy in 1904 and the present Italian capacity of 435 MW powers most of the State Railway system. Production and development in the USA is described, including recent steam production on Hawaii. Development in the USA is largely hampered by regulatory constraints. Japan's approach is aggressive; plans call for 50 GW production by the year 2000. Iceland and Mexico both have an impressive resource base, and exploration continues in Central and South America, the Caribbean, the Philippines, the Soviet Union, and Indonesia. France has developed several space-heating projects at home and is conducting studies in her territories abroad. Other work is underway in several African nations. The present electrical output and near-future expansion plans for operational systems throughout the world are tabulated.

### USA

*REFER ALSO TO CITATION(S) 21061, 21391, 21438*

**21392 Outlook for utility development of geothermal resources.** LaMori, P.N. (Geothermal Resources Council, Palto Alto, CA). *Trans. Am. Nucl. Soc.;* **27**: 6(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21393 Geysers geothermal field.** Kilkenny, J. (Geothermal Resources Council, Alhambra, CA). *Trans. Am. Nucl. Soc.;* **27**: 6(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### NON-USA

**21394** (CONF-761219—) **Argentine hydrothermal panorama.** (Instituto Nacional de Ciencia y Tecnica Hidricas, Buenos Aires (Argentina)). Dec 1976. 101p. (In Spanish). (CONF-761243—). Dep. NTIS (US Sales Only), PC A06/MF A01.

From 12. international congress of hydrothermal techniques; Buenos Aires, Argentina (12 Dec 1976).

An attempt is made to give a realistic review of Argentine thermal waters. The topics discussed are the characteristics of the hydrothermal resources, classification according to their mineral content, hydrothermal flora and fauna, uses of hydrothermal resources, hydrothermal regions of Argentina, and meteorology and climate. A tabulation is presented of the principal thermal waters. (JSR)

**21395** (NP—22124) **Where is Argentina going in geothermal energy.** Mange, J. (Instituto Nacional de Ciencia y Tecnica Hidricas, Buenos Aires (Argentina)). 1977. 8p. (In Spanish). Dep. NTIS (US Sales Only), PC A02/MF A01.

A brief review is given of geothermal exploration and development in Argentina. Methodical efforts to inventory the geothermal resources of the country were begun in 1974. The Commission set itself the task of locating the geothermal anomalies and then selecting particular anomalies for intensive exploration in order to confirm or discard the possibilities of exploiting the resource. The known principal anomalies are listed and the two selected for intensive exploration are indicated. (JSR)

**21396 Perspectives on geothermal energy in France.** Ruhla, C. (Univ., Lyon). *Sci. Tech. (Paris);* No. 43, 22-28(Jun 1977). (In French).

A review is presented of the basic theoretical concepts required for the understanding of geothermal energy and its exploitation. Included are the methods of calculation of geothermal gradient and flux, discussion of hydrogeological concepts and the methods of choosing sources and systems. Basic thermodynamic approaches to energy use and energy sources are stressed. Due to the nature of geothermal resources in France, their development is oriented toward utilization for direct space heating. The installation currently in use at Creil is described in detail. This installation uses 2 production wells and 2 reinjection wells. Water is produced at a rate of 200 $m^3/h$ at a temperature of 65°C and after heat extraction it is reinjected at 10°C. This installation saves the energy equivalent to 3500 t/yr of petroleum (68% of the amount of oil required for a conventional heating system). In France's most promising regions (the Paris Basin, Aquitain Basin, Alsace and Limagne) the most suitable sites for exploitation are Mont-de-Marsan, Villeneuve la Garenne, Strasbourg, Clermont-Ferrand, Tarbes, Massy, Ivry and Soissons. The primary developmental objective is 600 production and 600 reinjection wells in a ten year period. The Bureau de Recherche Geologique et Minieres estimates that in a ten year period these 1200 wells can provide heat for 1,200,000 homes and energy savings equivalent to 1 million tons of oil (0.57% of France's 1974 energy use). The capital investment required would be high and government assistance is recommended. An appropriation of 600 million Francs should suffice to achieve this goal.

**21397 Trends of geothermal power generation.** *Nenryo Kyokai-shi;* **56**: No. 7, 566-568(1977). (In Japanese).

Four geothermal power generating stations were on-line in Japan during 1976, adding to the country's energy supply. At the Matsukawa and Otake plants, which have been in operation for ten years, the load factors were 78% and 95% respectively. At the Onuma and Onikobe plants, operations began before all production wells were completed. All wells are now finished and the authorized power output was increased to 7.5 MW at Onuma and 12 MW at Onikobe. At the Hatchobaru and Kuzuneda power plants, where 50 MW facilities are being completed, operations are expected to commence in June of 1977 at Hatchobaru and August of 1978 at Kuzuneda. The exploration status of sites being studied by the government is as follows: 500 m test wells at Shikotsu and Doya; 500 and 800 m wells at Shimokita; 500, 700, and 800 m wells and an 18 km electrical prospecting well in the southern Hachimantai area; a 500 m well in the Kita Alps; and 700 and 800 m wells in the Wakibuta area. Mitsubishi plans to drill in the Yakedake area, and the Japan Metals and Chemical Company is drilling for a 500 MW power plant at Nigorikawa on Hokkaido, in cooperation with the Hokkaido Power Company.

**21398 Present and future status of geothermal power generation in Japan and abroad.** Sumi, K. (Geol. Survey of Japan). *Haikan To Sochi;* **17**: No. 9, 4-12(1977). (In Japanese).

The status of geothermal electricity production in 30 countries is reviewed. Japan has been expanding her facilities steadily since 1970. The Matsukawa (22 MW) and Otake (13 MW) power plants have been operational since 1966 and 1967, respectively, and the Matsukawa plant will shortly be expanded to 90 MW. Also operational are Onuma (10 MW), Onikobe (25 MW), and Hatchobaru (50 MW). A power plant at Takinoue (50 MW) is expected to go on-line in late 1977 or early 1978. Also under development are geothermal fields at Nigorikawa (Hokkaido), Ogachi (Akita), and Yakedake (Gifu). On Taiwan (Formosa), geothermal resource development has been concentrated in the areas of Tatun (north of Taipei) and Matsao, where high temperature reservoirs have been located, and in Tuchang, where well-bottom temperatures as high as 173°C have been encountered. In China, experimental power plants have been built at Fenshun, Canton, Kairai, and Hopei, and hot water has been produced at the Tochu volcano (Yunan). In the Philippines, considerable development is underway at Tiwi (Luzon), where a 100 MW power plant is due for completion by the end of 1977. Exploration is underway at Los Banos (Luzon) and Tongonan (Leyte). Nine references are provided.

## GEOLOGY, HYDROLOGY, AND GEOTHERMAL SYSTEMS

*REFER ALSO TO CITATION(S) 21448*

**21399 Jihin ha sokudo no jikanteki henka o okosu kiko (mizu to netsu no sayo). (Mechanism of change with time of seismic wave speed (effect of water and heat)).** Hayakawa, M. Tokyo; Seismological Society of Japan (1977). 1p. (CONF-770590—3).

From Meeting of the Seismological Society; Tokyo, Japan (12 May 1977).

The existence of water in a high temperature geothermal zone and the rate of crustal geothermal flux were considered, together with dynamic force, as components in an earthquake mechanism. Their effect on the extent to which the speed of a seismic wave is changed and its change with time (for use as an earthquake prediction tool) was studied. It was assumed that fusion proceeds from the central part of a hypocentral region and that Lindemann's equation describes the change in Vp/Vs at the time of phase transition. The effect of heat in the upper mantle and in the crust was examined using experimental results on speed change which occurs with temperature prior to fusion. The results and their applications to the interpretation of precursory phenomena are summarized and illustrated.

### USA

**21400 (LBL—7000) Geothermal reservoir engineering management program plan (GREMP Plan).** (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1977. Contract W-7405-ENG-48. 142p. Dep. NTIS, PC A05/MF A01.

A plan was formulated for development of the geothermal resources of the United States. Six major elements were identified to make up the research program structure. These are: properties of materials; definition of reservoir characteristics; description of example reservoirs; modeling the behavior of geothermal systems; exploitation strategies; and economics. The six elements yield twelve research categories and fifty research projects. These are discussed in detail in Appendix A and summarized in a table. (JGB)

**21401 Sandia/USGS magma workshop.** Ward, P.L. (Geological Survey, Menlo Park, CA). *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 311(May 1977).

### NON-USA

**21402 Geothermal system of the northern Hachimantai area.** Yora, M.; Watanabe, K.; Ito, J.; Wakita, K.; Kubota, Y. *Kozan Chishitsu;* No. 27, 233-244(1977). (In Japanese).

The Mitsubishi Onuma power plant is equipped with a 10 MW generator and has been operational since 1973. It presently provides low cost electrical power to the Mitsubishi Akita refinery. The plant is located in the nothern Hachimantai geothermal field, the geology of which consists of Neogene sediments and volcanics overlain by Quaternary volcanics. Many volcanoes are distributed across a block which was thrust upward during faulting and folding episodes. The structural evolution of the geothermal field from the Late Tertiary to the Holocene is illustrated. The distributions of geothermal alteration minerals such as zeolites and sericite indicate that two thermal or volcanic systems existed along the anticlinal axis of the fold belt within the major graben (the thrust block is located centrally within the graben). The distributions of clinoptilolite, chlorite, sericite, montmorillonite, laumontite, wairakite, epidote, pyrophyllite, and carbonates are plotted against temperature and depth, and several cross-sections are provided. Twenty-two references are given

## GEOTHERMAL EXPLORATION AND EXPLORATION TECHNOLOGY

*REFER ALSO TO CITATION(S) 21451*

**21403 Hot dry rock: widespread but invisible.** *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 299-302(May 1977).

Discussion at a meeting held on June 22, 1976, at Los Alamos Scientific Laboratory on the subject of Exploration Methods for Hot Dry Rock (HDR) is reported undcr the subject headings: geological methods; heat flow; seismic studies; electromagnetic methods; gravity methods; and exploration. The importance of using a variety of exploration techniques to assess HDR regions was emphasized.

### GEOPHYSICAL TECHNIQUES AND SURVEYS

*REFER ALSO TO CITATION(S) 21136, 21400, 21401, 21451, 21452*

**21404 (NP—22319) Does temperature affect electric resistivity of rocks in the Larderello region.** Albo, M.; Cameli, G.M.; Cataldi, R. (Compagnie Generale de Geophysique, Massy (France); Ente Nazionale per l'Energia Elettrica, Pisa (Italy). Centro di Ricerca Geotermica). 1976. 3p. Dep. NTIS (US Sales Only), PC A02/MF A01.

The geoelectric resistivity method has been applied extensively in the Larderello region since 1950. From 1950—1969, 6,792 vertical electrical soundings (VES) were made with an electrode separation of 2 to 6 km. The more than 300 deep wells drilled in the area give an objective basis for VES calibration and construction of reliable cap rock resistivity and substrata resistivity maps. The thousands of thermometric measurements taken in the area enable the construction of thermal maps at many depths. This vast amount of data permits a study of the relationship between resistivity and temperature. The study was undertaken from two points of view: geological, by cross-correlation of thermal, geological and geoelectric maps; and mathematical, by statistical processing of empirical resistivity and temperature values. It was concluded that a correlation between resistivity and temperature can be clearly shown in low resistivity terrains but is nearly impossible to clearly identify in nonhomogeneous formations.

**21405 Magnetotelluric measurements over Kilauea Iki lava lake.** Bostick, F.X.; Smith, H.W.; Boehl, J.E. (Univ. of Texas, Austin). *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 312(May 1977).

**21406 Mapping lateral boundaries of a cooling basaltic lava lake using ELF and VLF induction techniques, Kilauea Iki, Hawaii.** Anderson, L.A.; Zablocki, C.J.; Flanigan, V.J. *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 311(May 1977).

**21407 Mapping a magma reservoir by locating thermal cracks.** Chouet, B.; Aki, K.; Zandt, G. (Massachusetts Inst. of Tech., Cambridge). *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 311(May 1977).

**21408 Geological remote sensing-evaluation of image data.** Nagatani, H. *Kogyo Gijutsu;* **18**: No. 7, 76-80(1977). (In Japanese).

During the nationwide geothermal investigation program (Japan) begun in 1973, five districts were chosen for evaluation of the effectiveness and limitations of aerial thermography. Using thermal images of Ibusuki City and Yamakawa-cho, geothermal resource areas were detected and related fracture zones were established by combining the thermal imagery and geological maps. At Ibusuki City, it was determined that the heat source was the Ata caldera, and that a fracture system connecting it to Lake Ikeda provides a conduit for geothermal fluids. Image plotting of thermal anomalies in the Hachimantai geothermal field was found to be an effective method for monitoring variation in thermal activity. LANDSAT imagery was anlayzed and lineament systems were detected in the mountains of the Kanto district. Followup of LANDSAT data by mapping teams confirmed a fault which intersects the major Kamitsuna fault in that district. This successful use of remote sensing data is encouraging but it is possible to draw only limited conclusions from it at present. Further refinement of analytical techniques is required.

**21409 Studies of deep, widespread geothermal resources.** Baba, K. (Geol. Survey of Japan). *Chinetsu Gijutsu;* No. 7, 68-74(1977). (In Japanese).

A review is presented of exploration methods applicable to large scale geothermal resources. These techniques include geophysical surveys, remote sensing, and geochemical surveys. Prominence is given to artificial magnetotellurics and thermal imagery. Artificial magnetotellurics can be used to obtain a vertical profile by fixing the receiver/transmitter distance and varying the frequency of the generated electromagnetic field, eliminating the step of moving the electrodes. Theoretical exploration curves were prepared, incorporating experimental data from the Hachimantai geothermal field. The Hachimantai field was also used in studies of thermal imagery, which incorporated LANDSAT data in order to detect characteristic topographic indications of geothermal resources.

**21410 Terrestrial heat flow in two deep holes in the Ostrova-Karvina coal basin.** Cermak, V. (Geofyzikalni ustav CSAV, Czech.). *Vestn. Ustred. Ustavu Geol.;* **51**: 75-84(1976).

The heat flow values were determined in two boreholes in the Ostrova-Karvina coal basin, which is located in the Czechoslovakian portion of the Upper Silesian Basin. The boreholes were SV-1 (49°35.7'N, 18°16.9'E), and SV-2 (49°48.4'N, 18°31.7'E). The heat flow measured in SV-1 was 77.5 mW/m² (1.85 HFU) and in SV-2 it was 90.0 mW/m² (2.17 HFU); the corresponding temperature gradients were 30.4 and 30.6°C/km, respectively. The measurements were performed before the holes had reached thermal equilibrium, and were corrected using a logarithmic expression after Lachenbruch and Brewer (1959). The relatively high heat flow values are in good agreement with those previously obtained in the same area.

**21411 Geothermal studies in the MacKenzie Valley by the Earth Physics Branch.** Judge, A.S. Ottawa; Information Canada (1975). 16p. (NP—22636). .

As part of the Environmental-Social Program, Northern Pipelines, the Earth Physics Branch of the Department of Energy, Mines and Resources has carried out field observations of both the shallow and deep thermal regime of the Mackenzie Valley, conducted laboratory measurements of the thermal properties of subsurface soils and rocks, both frozen and unfrozen, has examined theoretically the thermal effects resulting from changes in the surface energy balance and compared these results with some observed temperature profiles. Such studies are necessary for an adequate assessment of the environmental impact of proposed northern construction and development. Through the existing program of the Earth Physics Branch, the work on the thermal behaviour of permafrost areas will continue to add to the volume of available data and enhance our understanding of the phenomena.

### GEOCHEMICAL TECHNIQUES AND SURVEYS

*REFER ALSO TO CITATION(S) 21400, 21451*

**21412 Nuclear techniques in geochemical studies of hydrothermal systems.** Bowman, H.; Wollenberg, H.; Asaro, F.; Apps, J. (Univ. of California, Berkeley). *Trans. Am. Nucl. Soc.;* **27**: 172(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## LEGAL AND INSTITUTIONAL ASPECTS

*REFER ALSO TO CITATION(S) 21429, 21430, 21431*

**21413** (TID—3365) **Legal and institutional impediments to geothermal energy resource development: a bibliography.** (Energy Research and Development Administration, Washington, D.C. (USA)). Jan 1978. 108p. Dep. NTIS, PC A06/MF A01.

This bibliography contains 485 references to literature on the subject of legal and institutional constraints to the development and use of geothermal resources. In addition to government-sponsored reports, journal articles, and books, the bibliography includes specific state and Federal laws and regulations, court cases of interest, and conference proceedings. For each reference, abstract or a listing of subject descriptors is given along with the complete bibliographic citation. Corporate, author, subject, and report number indexes are included. (LS)

**21414 Institutional and environmental aspects of geothermal energy development.** Citron, O.R. (Jet Propulsion Lab., Pasadena, CA). *Nucl. Technol.;* **34**: 38-42(Jun 1977).

The increasing interest in exploiting the variety of geothermal resources has prompted an examination of the institutional barriers to their introduction for commercial use. A significant effort was undertaken by the Jet Propulsion Laboratory as a part of a national study to identify existing constraints to geothermal development and possible remedial actions. These aspects included legislative and legal parameters plus environmental, social, and economic considerations.

**21415 Regulatory, planning and policy aspects of geothermal energy development in Imperial County, California.** Buck, J.V.; Gluck, D.; Hagman, D.; Krier, J.; Thompson, S. . Riverside, CA; Dry Lands Research Inst. (1977). vp.

Political and legal aspects of various possible county regulations that could apply to geothermal development are reviewed. (PCS)

**21416 Population analysis relative to geothermal energy development, Imperial County, California.** Pick, J.B.; Jung, T.H.; Butler, E. . Riverside, CA; Dry Lands Research Inst. (1977). 118p.

The following topics are covered: general demography, economic effects on migration, energy capacity and consumption, population and economic statistics for Imperial County, 1950—1970, regional socioeconomic comparisons, discriminant analysis of geothermal areas, Spanish-American population of Imperial County, regional employment implications for geothermal energy development, population projections and transferability of methods and results. (MHR)

**21417 Geothermal resources operational Order No. 6: pipelines and surface production facilities.** Washington, DC; Geological Survey (1977). 7p.

This Order (effective January 1, 1977) is established pursuant to the authority prescribed in 30CFR270.11. The design, operation, and testing of all pipelines and surface facilities will be conducted in accordance with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30CFR270.48. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Geothermal Supervisor or his delegated representative. The design of all pipelines and surface facilities, including but not limited to, production, injection, and waste water disposal systems, shall be submitted with the Application for Permit to Drill or on a Sundry Notice to the Supervisor for approval prior to construction. In addition, a Plan of Operation with contents and approval according to 30CFR270.34 shall be required when surface of environmental disturbances are anticipated beyond those covered by a previously approved Plan of Operation. Guidelines for design and construction, applying for construction of pipelines and related surface facilities, and the completion report are given.

**21418 Geothermal resources operational Order No. 7: production and royalty measurement, equipment, and testing procedures.** Washington, DC; Geological Survey (1977). 7p.

This Order (effective January 1, 1977) is established pursuant to the authority prescribed in 30CFR270.11 and 270.12 and in accordance with 30CFR270.60, 270.64, 270.74, and 270.75. All geothermal production, and the resulting produced energy (electricity) or by-products, and leasehold operational utilization thereof shall be measured and monitored in accordance with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30CFR270.48. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Geothermal Supervisor or his delegated representatives. Metering, commingling production, common storage, meter testing and maintenance, and application for meter installation criteria are furnished.

**21419 Geographical environmental analysis. Final report.** Pasqualetti, M.J. . Riverside, CA; Dry Lands Research Inst. (1977). 177p.

Interim conclusions concerning potential environmental impact from geothermal resource development in the Imperial Valley are made. Environmental effects from the initial phases of geothermal development will be minimal; however, no method of prediction can substitute for actual operation experience. Policy alternatives and recommendations for dealing with the environmental impact are discussed. (PCS)

**21420 Institutional barriers to geothermal energy development. Second report of the Institutional Barrier Panel to the Geothermal Advisory Council.** Washington, DC; Federal Energy Administration (1976). 12p.

Recommendations for remedial actions either through legislative and/or regulatory amendment or by directed agency action are given for three areas of study: delays in issuance of noncompetitive leases; drilling permit delays; and casual use, burdensome and discriminatory treatment of lessees. Other subjects considered resolved through other avenues were: force majeure clause in the lease agreement; assessment of geothermal resources on Indian Lands; steam price review; redefinition of KGRA and reclassification of noncompetitive lease tracts; limitation of the Secretary of Interior's discretion to readjust lease terms and conditions; royalty rebate; and royalty reduction contingencies. (PCS)

**21421 Institutional barriers to geothermal energy development. A report by the Institutional Barrier Panel to the Geothermal Advisory Council.** Washington, DC; Federal Energy Administration (1976). 23p.

Recommendations for solving industry problems in the following areas are given: federal taxation policy; federal—state utility rate structure policy; federal—state environmental protection assessments; federal—state environmental standards for geothermal pollutants; resource assessment; overlapping lease applications; cash bonus competitive bidding; cumulative acreage limitation; utility uncertainty re supplier's performance; readjustment of terms and conditions of leases; minimum leasehold size limitations; work requirements; and delays in the issuance of noncompetitive leases on forest lands. (PCS)

**21422 Benefits of stimulating geothermal energy development with tax and research subsidies.** Knutsen, C.A. Richland, WA; Battelle Pacific Northwest Labs. (1976). 43p. (BNWL-SA—5934).

A technique is demonstrated for evaluating benefits of subsidies and examples are given for using it to determine the cost-benefit ratio. Examples use two preferential tax treatments as opposed to direct research grants for the high-temperature, low-salinity hydrothermal resources. Results are compared and some conclusions are given. (PCS)

**21423 Legal, institutional, and political problems in producing electric power from geothermal resources in California.** Schuller, C.R.; Schilling, A.H.; Cole, R.J.; Simon, G.D. Seattle; Battelle Human Affairs Research Center (1976). 392p.

Non-technical problems hampering the production of electric power from geothermal resources are identified and possible solutions offered. These problems usually occur when one participant in the geothermal process has to deal with another. Laws that shape those interactions are examined in ten major groups: leasing, exploration, reaching agreement for utilization, power plant construction, transmission, financing, environmental reporting, the role of the California Energy Commission, proposed air pollution regulations, and the political economics of individual counties. (PCS)

**21424 Legal and institutional factors. Geothermal research study in the Salton Sea region of California.** Bates, M.R.; Krier, J.E.; Montgomery, W.D. . Pasadena, CA; California Inst. of Tech. (1975). 18p.

Recommendations are discussed for the conduct of a research and demonstration program directed to commercial exploitation of the geothermal resources of the Salton Sea region of California. The legal and institutional aspects of geothermal energy exploitation which need study are described. (MHR)

**21425 Geothermal resources operational Order No. 4: general environmental protection requirements.** Washington, DC; Geological Survey (1975). 21p.

This Order (effective August 1, 1975) is established pursuant to the authority prescribed in 30CFR270.11 and in accordance with 30CFR270.2, 270.34(k), 270.37, 270.41, 270.42, 270.43, 270.44, and 270.76. Lessees shall comply with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30CFR270.48. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Geothermal Supervisor or his delegated representative. Guidelines are specifically discussed for the following areas: aesthetics; land use and reclamation; public access; recreation; slope stability and erosion control; biota; cultural resources preservation; subsidence and seismicity; pollution, waste disposal, and fire prevention; water quality; and noise abatement.

**21426 Structure of the geothermal industry through 1974.** Montgomery, W.D. Pasadena, CA; California Institute of Technology (1975). 99p.

Four chapters are included which deal, respectively, with the technical and institutional conditions that shape geothermal development, the factors that determine the value of a geothermal lease, patterns of bidding for geothermal leases offered by the Federal government, and the emerging structure of the geothermal industry. The final chapter is a summary of conclusions and recommendations for further research.

## ECONOMIC AND FINANCIAL ASPECTS

*REFER ALSO TO CITATION(S) 21413, 21418, 21421, 21422, 21426*

**21427** (SAN—115P108-1(Vol.2)) **Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power.** Barrager, S.M.; Quinn, D.J. (Stanford Research Inst., Menlo Park, Calif. (USA)). May 1977. Contract EY-76-C-03-0115-108. 127p. Dep. NTIS, PC A07/MF A01.

Results of a study on the evaluation of potential for geothermal energy development and utilization in California are reported. This is Volume II of the two-volume report. The first four chapters of this volume present a generic analysis of several decisions facing government in the field of hydrothermal energy. The analysis develops a framework for estimating the potential overall benefits of hydrothermal power (detailed in Appendix A). Chapter V contains a site-specific analysis of the decision to fund a demonstration plant at Heber, California. This analysis is performed from the point of view of both the government and the local-electricity consumer. The specific numerical results presented are limited to electrical power generated by hot water systems. (JGB)

**21428** (SAN—115P108-1(Vol.1)) **Economic analyses of geothermal energy development in California.** Ramachandran, G. (Stanford Research Inst., Menlo Park, Calif. (USA)). May 1977. Contract EY-76-C-03-0115-108. 147p. Dep. NTIS, PC A07/MF A01.

Results of a study on the evaluation of potential for geothermal energy development and utilization in California are reported. Volume I of the two-volume report deals with hydrothermal resource costs and economics in terms of various critical parameters pertaining to specific resource locations in California. The important economic factors that influence the development and growth of hydrothermal resources and the probable costs of a hot-water demonstration power plant are also considered. A set of near-term actions and their estimated impacts on hydrothermal resource economics are also discussed. (JGB)

**21429 Economic impact of geothermal energy development.** Rose, A. . Riverside, CA; Dry Lands Research Inst. (1977). 103p.

While this investigation is basically a case study for the Imperial Valley, many of the results are applicable to geothermal development elsewhere and to development of other new energy sources, solar and tidal power, which all share common characteristics. Thirteen major economic indicators are analyzed for direct, secondary economic and demographic effects are given for the primary development scenario which calls for 4500 MW of electric generating capacity, in Imperial County by the year 2020. Impacts on agriculture, income distribution, employment, occupational variety, fiscal impact, and potential costs for pollution abatement or control are discussed. A summary of policy recommendations is given for local control over each socio-economic variable. (PCS)

**21430 Multisector analysis of the impact of geothermal development on the economy of Imperial County, California.** Lofting, E.M. . Riverside, CA; Dry Lands Research Inst. (1977). 78p.

An 85 sector input—output model or Imperial County was developed for 1972. The model was based on secondary data sources and modified national technical coefficients using the SLQ technique. Type I and type II income, employment, and value added multipliers were developed for each sector. Projections of economic activity were made for the 1975—2020 period based on population projections which (I) assumed no geothermal development in the county and (III) assumed geothermal development and relatively rapid population growth. Agricultural development was assumed to grow to 1.8 times its present level in both cases. For the Series I projection per capita income in 1972 constant dollars will remain essentially constant, while in the Series III projection it is estimated to increase from $4500 to $7100 per year. In both cases the employment to population ratio can be expected to remain relatively constant. Geothermal development is projected to add $700 million per year to the personal income of Imperial County by the year 2020. The linear programming analysis reveals that achieving projected growth in agricultural output will require an improvement in water use efficiency of at least 35%. When compared to alternative policies, such as attempting to maximize gross county product, employment maximizing policies may not result in significant increases in employment.

**21431 State taxation of geothermal resources compared with state taxation of other energy minerals.** Wagner, S.C. . Washington, DC; Geological Survey (1976). 59p.

Comparisons of state taxation on the energy minerals (coal, oil shale, uranium, oil, and natural gas) to that of geothermal energy in six western states (California, New Mexico, Utah, Idaho, Nevada, and Oregon) are given for planning economics of geothermal resource development. Separate sections include: property taxes; severance taxes; corporate franchise; income and excise taxes; oil and gas production or conservation taxes. An appendix of geothermal resources and by-products definitions is included and tax charts are arranged by state and by type of tax. (PCS)

## ENVIRONMENTAL ASPECTS AND WASTE DISPOSAL

*REFER ALSO TO CITATION(S) 21399, 21417, 21421, 21425, 21450*

**21432** (LA—6972) **Environmental investigations associated with the LASL hot dry rock geothermal energy development project.** Rea, K.H. (Los Alamos Scientific Lab., N.Mex. (USA)). Dec 1977. Contract W-7405-ENG-36. 25p. Dep. NTIS, PC A02/MF A01.

The Los Alamos Scientific Laboratory (LASL) is currently evaluating the feasibility of extracting thermal energy from hot dry rock (HDR) geothermal reservoirs. An overview of the environmental studies that LASL has conducted relative to its HDR Geothermal Energy Development Project is presented. Because HDR geothermal technology is a new field of endeavor, environmental guidelines have not been established. It is anticipated that LASL's research will lead to the techniques necessary to mitigate undesirable environmental impacts in future HDR developments. To date, results of environmental investigations have been positive in that no undesirable environmental impacts have been found.

**21433** (UCID—17632) **Geothermal environmental overview project.** Anspaugh, L.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1977. Contract W-7405-ENG-48. 15p. (CONF-771084—1). Dep. NTIS, PC A02/MF A01.

From Ecosystems workshop; Santa Rosa, CA, USA (25 Oct 1977).

The basic purpose of the Geothermal Environmental Overview Project is to summarize and assess the state of environmental issues of the top priority KGRAs from among the 37 KGRAs currently identified by the Division of Geothermal Energy as having possibility for commercial development. The objectives of the Over-

view Project are inventory of available data, assessment of available data, identification of data gaps, and identification of key issues. (JGB)

**21434 Environmental aspects of geothermal energy.** Crittenden, M. (Geothermal Resources Council, Menlo Park, CA). *Trans. Am. Nucl. Soc.;* **27**: 6-7(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21435 Geothermal Environmental Advisory Panel. Second annual report, July 1, 1975—June 30, 1976.** Menlo Park, CA; Geological Survey (1976). 6p.

Progress is reported in interagency cooperation for identifying mitigating measures for most environmental problems associated with geothermal development. The major problems that remain relate to preservation of certain unique geological and geothermal areas and certain delicate ecosystems: areas which are outside the purview of the Panel. (PCS)

## GEOTHERMAL POWER PLANTS

*REFER ALSO TO CITATION(S) 21392, 21393, 21427*

**21436 Technical issues in geothermal power development.** Fick, T.R. (Bechtel Power Corp., San Francisco). *Trans. Am. Nucl. Soc.;* **27**: 7(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21437 Heber Geothermal Demonstration Plant.** Swanson, C.R. (San Diego Gas and Electric Co., CA). *Trans. Am. Nucl. Soc.;* **27**: 8(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21438 Recent developments in geothermal energy.** Underhill, G. (Electric Power Research Inst., Palo Alto, CA). *Trans. Am. Nucl. Soc.;* **27**: 8-9(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### DESIGN AND OPERATION

**21439 Outline of heat cycles and facilities for geothermal power generation.** Inoue, T. (Toshiba Ltd., Japan). *Haikan To Sochi;* **17**: No. 9, 36-43(1977). (In Japanese).

A review is made of the common heat cycle modes used in geothermal power generating facilities. The heat cycles used are classified as four modes: backpressure, condensation, single-flash, and double-flash. The use of the backpressure mode eliminates the need for condensers and gas extractors, thus reducing capital cost. It also permits secondary heat recovery as the waste steam is discharged at a high temperature. However, the high exhaust pressure reduces the useful output of the turbine. The condensation mode enables the utilization of low enthalpy steam, increasing useful turbine output. The majority of operating geothermal power plants, including the Geysers and Matsukawa, use the condensation mode. The single-flash mode, used at Cierro Prieto and Kuzuneda, possesses a unique maximum performance point. This does not necessarily make the system more economical however, as the pressure drop requires an increased volumetric flow rate. Tiwi, Los Banos, and Hatchobaru have adopted the double-flash mode, which provides a 20%-30% greater power output than single-flashing. Two heat cycles under development are the binary-fluid and total flow concepts. Japan expects to have a 1.0 MW binary-fluid system on-line by late 1977; it is being built under the aegis of the Agency of Industrial Science and Development.

### POWER PLANT SYSTEMS AND COMPONENTS

**21440 New industrial development of geothermal resources.** Kuwada, J.T. (Rogers Engineering Co., Inc., San Francisco). *Trans. Am. Nucl. Soc.;* **27**: 8(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## GEOTHERMAL ENGINEERING

### DRILLING TECHNOLOGY AND WELL HARDWARE

**21441 Petrological approach to development of geothermal energy.** Takada, A. *Saiko To Hoan;* **23**: No. 5, 32-42(1977). (In Japanese).

The status of geothermal research and development throughout the world, and particularly in the western USA, is reviewed. Performance characteristics of the Geysers plant in California are described, with special attention given to reinjection programs. The problems of drilling deep wells in geothermal areas are discussed. New techniques of drilling, including subterrene penetrators which utilize lasers, electron beams, ultrasonics, electrical arcs, nuclear plasma, and explosives are described, and the drilling rates associated with their use are tabulated. Chemical and mechanical drilling are also discussed. Twenty-five references are provided.

**21442 Field test of mud on temperature effect.** Tanaka, S.; Miyazawa, M. *Sekiyu Gijutsu Kyokaishi;* **42**: No. 5, 22-26(Sep 1977). (In Japanese).

Under well-bore conditions of high temperature and pressure, drilling mud becomes aged during a round-trip through the borehole. By circulating mud through a borehole, it is possible to determine its response to these conditions. Field tests were carried out at Shisekihara well during September, 1976. The mud properties were measured every 20 minutes for a period of three hours after circulation to a depth of 2289 m. Five samples were also taken for subsequent laboratory examination. The results indicate that the apparent viscosity of the mud increases with circulation time and then drops off to a stable level after one round-trip through the well. The yield value of the mud showed greater aging effects than the viscosity. It was assumed that a dispersing agent in the mud was decomposed. By comparing properties measured at the well site with those obtained in the laboratory, the effect of temperature was determined. The plastic viscosity of the mud decreased with increasing temperature, but yield value increased. The variation of apparent viscosity with temperature was highly complex, and is not a suitable index of properties.

**21443 Casings for geothermal wells.** Saigo, T. (Japan Steel Tube Co.). *Haikan To Sochi;* **17**: No. 9, 23-35(1977). (In Japanese).

The API (American Petroleum Institute) standards for oil well casings are described, as well as casings developed by Japan Steel Tube Company which are not included in the API standards. Most casings now in use are based on API J-55, and casing materials for shallow wells are based on K-55 or H-40. The selection of casing materials for geothermal wells is based on the well depth and the specific properties of the steam or hot water present. Recent trends indicate that very high strength materials are being chosen. The grades developed by Japan Steel Tube are: NKAC-90, NKT-95, NKS-135, NKV-150, NKLT-95, NKLT-110, and NKLT-135. The NKAC-90 grade has excellent resistance to sulfides and stress-corrosion cracking, and has a yield strength of 63.3-73.8 kg/mm$^2$. The NKT-95 has a higher yield strength (66.8-87.9 kg/mm$^2$). NKS-135 and NKV-150 are high tensile strength tubings developed for use in deep wells, and have greater strength than API P-110. The NKLT-95, NKLT-110, and NKLT-135 casings were developed for use in cold climates and have superior low-temperature strength, ductility, and impact qualities.

**21444 Studies of cement for geothermal power generation.** Nakamura, A. (Nihon Cement Co., Japan); Amaya, T.; Kobayashi, K.; Tsuji, M. *Semento Gijutsu Nenpo;* **30**: 109-112(1976). (In Japanese).

Three varieties of geothermal well cements with different $C_3S$ and $C_3A$ contents, having their $CaO/SiO_2$ molar ratio adjusted so as to be less than 1.0, were examined after exposure to geothermal well conditions equivalent to a 115°C circulation temperature and a 220°C standing temperature. A 45% water-cement slurry was cast in 2.0 in $^3$ molds and autoclaved at 220°C after a heating at a rate of 1.5°C/min. Also, specimens cast in 125.0 cm$^3$ molds were autoclaved at 220°C for 3.0 h and were hung within a borehole at Takinoue geothermal field for 180 days. The samples aged in the borehole exhibited increased strength, as did those cured in the autoclave. None of the specimens exhibited signs of thermal alteration. This is attributed to the presence of added silica agents. Cement slurry to which more than 0.3% lignin retarder had been added had a thickening time in excess of 100 min at a well-bottom circulation temperature of 115°C. Two references are provided.

### FLUID TRANSMISSION

**21445 Piping facilities for geothermal power stations.** Tagawa, T. (Mitsubishi Heavy Industries, Japan); Iwata, H.; Morikawa, Y. *Haikan To Sochi;* **17**: No. 9, 13-21(1977). (In Japanese).

Mitsubishi Heavy Industries has carried out a considerable amount of research relative to the pecularities of two-phase transport systems. Most of this work was performed during the planning

stages of the Otake geothermal power plant. The design developed has been successfully applied at the Hatchobaru power plant as well. The general design considerations include the use of a sluice gate-valve or a sluice/conduit gate-valve at the wellhead. The angled section of the pipe directly above the wellhead is equipped with a detachable 'target plate' which protects the bend from erosion by particulate material carried by the steam-water mixture. This portion of the transmission system must also be equipped with vibration arresting equipment as considerable vibration is caused by the highly turbulent flow at the wellhead. All of the wellhead equipment is fabricated from stainless steel. When steam supply exceeds the turbine demand, excess steam is released to the atmosphere. In a single-flash mode this is accomplished by a valve located at the steam receiver. In a double-flash mode it is valved at the separator and flasher. Safety valves are located at strategic points throughout the system. Experience at Otake, Onuma, and the geothermal fields of El Salvador has shown that stainless steel components are not necessary for most of the equipment. Standard carbon steel is sufficient for large caliber transmission pipes. Four references are provided.

**21446 Plan for steam transport facilities at Kuzuneda geothermal power plant.** Matsuura, S. (Japan Steel Tube Co.). *Haikan To Sochi;* **17**: No. 9, 44-54(1977). (In Japanese).

At the Kuzuneda geothermal field, the construction of a 50 MW power plant is near completion. The work performed as of 1977 included 6 test wells and 14 production wells, steam collection and transport facilities, and most of the power plant facilities. The steam transport pipes were designed to use JISG-3102 steel and SB-42, 3-5.5 DR bent valves; JIS 10K slip-on flanges; bellows type expansion pipe of SUS-316 (20-42B size, plus-or-minus 20-85 mm expansion); and motorized sluice-valves. The steam at the field is produced at a rate of 560 t/h (40 t/h/well) and hot water is produced at 2800 t/h (200 t/h/well). The steam pressures are: 40 kg/cm$^2$ at the wellhead cutoof, 10 kg/cm$^2$ wellhead service, and 3.5 kg/cm$^2$ at the main stop-valve. The temperature at the main stop-valve is 147°C, and the steam is 99.7% dry. The steam is 99.9% $H_2O$ and 0.10% gas, the gas fraction being 73.62% $CO_2$, 18.4% $H_2S$, and 8.0% R. The average pH of the steam is neutral to weakly alkaline. Three modes of fluid transport are involved; two-phase from wellhead to separator, single-phase (steam) from separator to turbine, and single-phase (water) from separator to reinjection well.

## CORROSION, SCALING, AND MATERIALS DEVELOPMENT

**21447 Development of geothermal energy: some problems.** Rimstidt, J.D.; Barnes, H.L. (Pennsylvania State Univ., University Park). *Earth Miner. Sci.;* **47**: No. 2, 9-12(Nov 1977).

The precipitation of mineral scale by geothermal waters is one of the problems presented by the development of geothermal energy. Studies on the mechanism of precipitation of the Salton Sea brines are reported. The two distinct types of scale produced by cooling and flashing are discussed. (JGB)

## GEOTHERMAL RESERVOIR AND WELL PERFORMANCE

*REFER ALSO TO CITATION(S) 21400*

## RESERVOIR STIMULATION AND EXTRACTION TECHNOLOGY

**21448 (LA—7021-C) Proceedings of the second NATO-CCMS information meeting on dry hot rock geothermal energy.** Mortensen, J.J. (comp.). (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1977. Contract W-7405-ENG-36. 77p. (CONF-7706105—(Summ.); NATO/CCMS—65). Dep. NTIS, PC A05/MF A01.

From 2. NATO-CCMS meeting on dry hot rock geothermal energy; Los Alamos, NM, USA (28 Jun 1977).

A summary is presented of the second and last NATO-CCMS (North Atlantic Treaty Organization—Committee on Challenges of Modern Society) Geothermal Pilot Study Information Meeting on Dry Hot Rock Geothermal Energy. Only summaries of the formal presentations are included. Overviews of the Energy Research and Development Administration (ERDA) and the U.S. Geological Survey (USGS) geothermal projects are included with emphasis on the Los Alamos Scientific Laboratory (LASL) Hot Dry Rock Geothermal Energy Development Project. Reports of developments in nine foreign countries and on geothermal projects in US universities are also presented.

**21449 (TID—28010) ERDA Geothermal Component Test Facility (GCTF), East Mesa, Imperial Valley, California. Test operations management plan.** (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 1976. Contract W-7405-ENG-48. 22p. Dep. NTIS, PC A02/MF A01.

Discussion of the operation of the Geothermal Component Test Facility (GCTF), established for testing heat extraction and energy conversion equipment and materials, is presented under the following section headings: purposes of the facility; operating policies: service, conflicts, safety and environmental, investigator activities, shops and equipment, and test certification; organization: chart; Lawrence Berkely Laboratory: organization, responsibilities, individual responsibilities, and funding; Bureau of Reclamation: organization, responsibilities, and funding; operations contractor: contract, qualifications, and personnel; Test Operations Advisory Board; experiment processing: test acceptance, scheduling and priorities, cost reimbursement, and activities flow chart.

# DIRECT ENERGY UTILIZATION

**21450 (SAN/1317—3) Use of geothermal heat for sugar refining. Final report, October 1, 1976—May 31, 1977.** Pearson, R.O. (TRW Systems and Energy, Redondo Beach, Calif. (USA)). May 1977. Contract EG-77-C-03-1317. 196p. Dep. NTIS, PC A09/MF A01.

The economic and technical feasibility of applying low grade geothermal heat (less than 300°F) in the beet sugar refining industry for both new factory construction and retrofit conversion of existing factories was assessed. The representative Holly Sugar factory at Brawley, California, was utilized as a baseline primarily because of its centralized location with respect to the known and partially developed geothermal anomalies at Brawley, East Mesa, and Heber. Nominal values for the key parameters of the sugar refining process and typical values for the geothermal fluid parameters representative of geothermal resources in areas of existing or potential future sugar factories were defined, promising points of application were identified, and conceptual designs synthesized for introducing the geothermal heat into the process. The design approaches were then quantified with capital, operating and maintenance costs, and comparative economic evaluations were made with other fuels projected to 1995. In parallel with the detailed study of process conversion to geothermal heat, the existing pattern and potential growth of the sugar refining industry was assessed to estimate the potential market for new factory construction at suitable areas, as well as the potential for retrofit conversion of existing factories. The environmental impact of other geothermal application concepts was also assessed, and expected technological or industry/government policy changes which might affect the potential for conversion to geothermal heat were identified and evaluated. Emphasis was placed on achieving results that would stimulate commercial utilization of geothermal heat for beet sugar refining and related processes.

# GEOTHERMAL DATA AND THEORY

*REFER ALSO TO CITATION(S) 21405, 21406, 21407*

**21451 Processes of heat accumulation and geothermal resource formation.** Austin, W. H. Jr. *Can. Min. J.;* **98**: No. 10, 36-40(Oct 1977).

Two significant sources of geothermal heat are recognized: radioactive decay within the lithosphere and regions where the heat of the asthenosphere is readily carried by the lithosphere. A hypothetical situation is described wherein the mantle bulges upward along a plate boundary or rift zone. The high local heat flow causes localized melting and the formation of incipient batholiths. Fractionation forms siliceous intrusives in the upper portions, which move upward and may detach. The siliceous melt absorbs water from the host rock and the resulting volatiles increase mobility and may eventually cause volcanism. The volcanic structures so formed collapse, and the cooling pluton releases copious hydrothermal fluids. A silica or carbonate seal forms and the system is isolated. Exploration for such a structure begins with satellite imagery of surface morphology and vegetative patterns. This is followed by detailed air-photo and field mapping, geochemical surveys, gravitational and magnetic surveys, and electrical surveys. Borehole determinations of heat flow may be used, but are not always reliable. The foregoing procedures are briefly described, and an example of cost estimation is given, based on experience at The Geysers geothermal field.

**21452 Fine-mesh passive seismic survey of Kilauea Iki lava lake.** Colp, J.L. (Sandia Labs., Albuquerque, NM). *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 311(May 1977).

**21453 Characteristics of geothermal conditions of the northern near-Boart zone of the Dnieper-Donets depression.** Gonta, Z.T. *Geol. Zh. (Russ. Ed.);* **37**: No. 4, 17-25(1977). (In Ukrainian).

The construction of deep wells in the Dnieper-Donets depression requires knowledge of geological conditions and temperature parameters. The thermal regime apparently has a direct effect on petroleum and gas distribution. The temperature distribution is affected by the presence of salt masses. These masses have a high thermal conductivity. Geothermal maxima were determined accord-

ing to the regional structural features, including overthrust faulting and the presence of salt masses. A thermal map was prepared giving isotherms at 4 km depth, as well as predicted isotherms for depths of 5, 6, and 7 km.

**21454 High heat flow measured in Ostrova-Karvina coal basin.** Cermak, V. (Geophys. Inst., Prague). *Stud. Geophys. Geod.;* **30**: 64-71(1976).

Seventy-four deep holes were drilled in the southern part of the Ostrova-Karvina Basin, near Frenstat. Thermal gradients within the wells, and the thermal conductivities of the strata penetrated were determined. All of the bores passed through the 900-1000 m thick covering formations and into the Carboniferous strata (represented mainly by sandstones and siltstones, with some limestones at the base). The well characteristics and heat flow determinations for five locations are summarized in tables. The new data from two of the holes agree with previous determinations of 1.75-1.90 HFU for this area, but the data from the remaining three are anomalously high and care must be taken in their use for interpretation of tectonics or deep structure. Anomalous heat flow values for the 1000-1200 m level may be due to local thermal effects or improper procedure during sampling, and cannot be resolved at this time.

### PROPERTIES OF AQUEOUS SOLUTIONS

*REFER ALSO TO CITATION(S) 21169*

### PROPERTIES OF MINERALS AND ROCKS

**21455 Crystal structure of synthetic proto-pyroxene $Li_{0.3}Sc_{0.3}Mg_{1.4}Si_2O_6$.** Smyth, J.R. (Los Alamos Scientific Lab., NM); Ito, J. *EOS, Trans., Am. Geophys. Union;* **58**: No. 5, 312(May 1977).

**21456 Observation of rock using a heating microscope.** Kuriyagawa, M.; Mizawa, S.; Matsunaga, I. *Saiko To Hoan;* **23**: No. 7, 337-344(1977). (In Japanese).

Samples of rock typical of Japanese geothermal fields were observed in a heating microscope. The specimens were heated to 1300°C at a rate of 200°C/h. Microphotographs were taken at each 200°C interval. Cracks developed at 600°C in the marble and at 800°C in the Sori granite. No remarkable changes were noted in sandy tuff, Kofu andesite, or Sanjome andesite. The rocks began to melt ar various temperatures in the neighborhood of 1200°C. After heating to 1300°C the specimens were cooled in the furnace. Both the Kofu andesite and the Izu sandy tuff had melted completely and had become vitreous. The marble had been reduced to powder. The Sori granite and the Sanjome andesite tended to retain their original form, but large cracks were present in the granite.

### ISOTOPE AND TRACE ELEMENT STUDIES

**21457 Oxygen and sulfur isotope equilibria in the $BaSO_4$—$HSO_4^-$—$H_2O$ system from 110 to 350°C and applications.** Kusakabe, M.; Robinson, B.W. (Dept. of Scientific and Industrial Research, Lower Hutt, New Zealand). *Geochim. Cosmochim. Acta;* **41**: No. 8, 1033-1040(Aug 1977).

Oxygen isotope exchange between $BaSO_4$ and $H_2O$ from 110 to 350°C was studied using 1 m $H_2SO_4$—1 m NaCl and 1 m NaCl solutions to recrystallize the barite. The slow exchange rate (only 7% exchange after 1 yr at 110°C and 91% exchange after 22 days at 350°C in 1 m NaCl solution) prompted the use of the partial equilibrium technique. However, runs at 300 and 350°C were checked by complete exchange experiments. The temperature calibration curve for the isotope exchange is calculated giving most weight to the high temperature runs where the partial equilibrium technique can be tested. Oxygen isotope fractionation factors ($\alpha$) in 1 m NaCl solution (110 to 350°C), assuming a value of 1.0407 for $\alpha$/ sub $CO_2$—$H_2O$/ at 25°C, are: $10^3$ ln$\alpha$/sub $BaSO_4$—1 m NaCl/ = 2.64 ($10^6/T^2$) -5.3 +- 0.3. These data, when corrected for ion hydration effects in solution (Truesdell, 1974), give the fractionation factors in pure water: $10^3$ ln$\alpha$/sub $BaSO_4$—$H_2O$/ = 3.01 ($10^6/T^2$) - 7.3 +- 0.1. In the 1 m $H_2SO_4$—1 m NaCl runs, sulfur isotope fractionation between $HSO_4^-$ and $BaSO_4$ is less than the detection limit of 0.4‰. A barite—sulfide geothermometer is obtained by combining $HSO_4$—$H_2S$ and sulfide—$H_2S$ calibration data. Barite in the Derbyshire ore field, U.K., appears to have precipitated in isotopic equilibrium with water and sulfur in the ore fluid at temperatures less than 150°C. At the Tui Mine, New Zealand, the barite—water geothermometer indicates temperatures of late stage mineralization in the range 100 to 200°C. A temperature of 350 +- 20°C is obtained from the barite-pyrite geothermometer at the Yauricocha copper deposit, Peru, and oxygen isotope analyses of the barite are consistent with a magmatic origin for the ore fluids.

# TIDAL POWER

## TIDAL POWER PLANTS

**21458 (UCID—17677) Analysis of a proposed tidal power plant in the Gulf of Mexico.** Moulthrop, P.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Dec 1977. Contract W-7405-ENG-48. 16p. MF A01.

Portions of document are illegible.

A short technical and economic analysis of a proposed tidal power plant in the Gulf of Mexico suggests that it is technically feasible, and the cost of electric power appears comparable with that from alternative sources. The potential for tidal power in California is also briefly reviewed; the amount of tidal power in California is not large and the cost would be very high.

# WIND ENERGY

## AVAILABILITY (CLIMATOLOGY)

**21459 (PNL—2436) Effect of generalized wind characteristics on annual power estimates from wind turbine generators.** Cliff, W.C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1977. Contract EY-76-C-06-1830. 57p. Dep. NTIS, PC A04/MF A01.

A technique is presented for estimating the average power output of a wind turbine using, as the wind characteristic input, only the mean annual wind magnitude. Hourly wind speeds are assumed to have a Rayleigh frequency distribution which requires a single parameter input (e.g., the mean value, variance or higher moment values). Based upon a general shape, for the wind speed versus machine output, a generic set of curves is developed to estimate the average power output of wind turbines. Also, estimates of the percent of time the wind turbine would not produce power (percent down time) and the percent of time the wind turbine would be operating at its rated power are presented.

**21460 (PNL—2442) Accuracy of wind power estimates.** Doran, J.C.; Bates, J.A.; Liddell, P.J.; Fox, T.D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1 Oct 1977. Contract EY-76-C-06-1830. 29p. Dep. NTIS, PC A03/MF A01.

Several aspects of power estimation techniques for wind energy conversion systems are studied. The sampling rate at which data are collected, ranging from once every 2 minutes to once every 3 hours, does not appear to significantly affect the average power for recording periods of one season. Increased averaging times produce small underestimates (less than 10 percent) of available power. The Rayleigh and Weibull distributions both give poor estimates of power for low mean wind speed situations, with the former being significantly worse. At higher wind speeds, both give good estimates, and the Rayleigh distribution is considerably simpler in form and application. A height extrapolation scheme for Weibull parameters is also investigated. Results are satisfactory for power estimates of ensembles of machines, but the scatter of values about the mean makes the method inappropriate for individual cases.

**21461 Variance analysis of wind characteristics for energy conversion.** Corotis, R.B.; Sigl, A.B.; Cohen, M.P. (Department of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Ill. 60201). *J. Appl. Meteorol.;* **16**: No. 11, 1149-1157(Nov 1977).

Variance analysis of hourly wind data is utilized to assist in wind characteristic assessment for direct energy conversion systems. Feasibility of large-scale wind energy utilization, as well as sitting, sizing and operating policy, depend on the variability of the wind. Several Midwestern sites are used to illustrate a temporal study of variance sources that leads to the evaluation of equivalent independent hours. For the sites considered these vary from two to three per day. This information is utilized to determine duration of survey requirements for stated confidence levels and desired accuracy. Reasonably reliable and accurate estimates of the mean seasonal wind can be obtained in one or two years for the sites analyzed.Autocorrelation and cross-correlation analysis confirms the existence of significant correlation in the wind at a single site for a period of 8—12 h and between sites for similar time lags and separations up to 100 km or more. Meaningful prediction of variation from the mean appears possible in these cases. The diurnal cycle effect is seen to depend significantly on season and elevation.

## WIND ENERGY ENGINEERING

*REFER ALSO TO CITATION(S) 21670*

### APPLICATIONS

*REFER ALSO TO CITATION(S) 21707*

### TURBINE DESIGN AND OPERATION

**21462 Effect of aerofoil characteristics on windmill performance.** Griffiths, R.T. (Univ Coll, Swansea, Wales). *Aeronaut. J.;* **81**: No. 799, 322-326(Jul 1977).

Application of blade element theory to the horizontal axis windmill has established a design procedure for the blades. It is shown that the airfoil characteristics have only small effects on the optimum planform shape and twist, but large effects on the performance. The maximum efficiency increases rapidly at first with lift/drag ratio up to about R=30, thereafter increasing less rapidly. The tip speed ratio at which this efficiency occurs also depends critically on the characteristics of the airfoil need. 8 refs.

# ELECTRIC POWER ENGINEERING

*REFER ALSO TO CITATION(S) 21745*

## POWER PLANTS AND POWER GENERATION

*REFER ALSO TO CITATION(S) 21538, 21742*

**21463 Concept of large power plants fired with bituminous coal.** Borgstedt, K.E. (Steinkohlen-Elektrizitaet A.G. (STEAG), Essen (Germany, F.R.). Geschaeftsbereich Anlagentechnik). *Energie;* **29**: No. 7, 204-210(Jul 1977). (In German).

Following the presentation of the reasons why there is no national uniform technical concept for the large power bituminous coal power plants, the essential boundary conditions are discussed which are criteria for technical concepts. They are economical considerations, standardization problems and legal permission. The article then describes the technical concept today which STEAG pursues these days for bituminous coal power plant blocks of the dimension of 700-750 MW.

**21464 Coal is the only solution.** (Bergbau-Forsch, Essen, Ger). *Energie;* **29**: No. 7, 193-195(Jul 1977). (In German).

In an interview with Professor Dr. W. Peters of the Coal Research Center in Essen, Federal Republic of Germany, the "Energy" reporter presents a summary about the future construction trend of power plants in countries having large reserves of coal deposits. The general idea is to use fluidized bed boilers and use the waste heat. Such energy generation may complete successfully in price for each kW produced, with nuclear power plants.

**21465 Design concept of large coal-fired power plants.** Borgstedt, K.E. (Steag-Anlagentech, Essen, Ger). *Energie;* **29**: No. 7, 204-210(Jul 1977). (In German).

The advantages offered by building very large power plants using bituminous coal as a fuel source are evaluated. It was concluded that the optimum size for a unit should be 700 to 750 MW of installed capacity.

**21466 Is the trend of building giant units of power plants justified.** Buch, A. (Tech Hochsch, Braunschweig, Ger). *Energie;* **29**: No. 7, 198-204(Jul 1977). (In German).

A cost analysis is made showing what are optimum unit sizes for a power plant with total installed power of 1200 MW. As a rule of thumb it may be concluded that some 10% investment and operational costs are less if large blocks are built instead of several small ones.

**21467 Combination of thermal power processes with a fuel conversion process.** Bachl, H. German(FRG) Patent 2,527,662/A/. 23 Dec 1976. 7p. (In German).

The gasification of fuels normally occurs at high temperatures and increased pressure. In order to increase the efficiency, it is recommended to carry out the heat production in at least two steps and to interpose the fuel conversion between them. By this means, also a higher yield of high-molecular hydrocarbons will be achieved, and one additional separation of the residual gas can be dispensed with. The initial temperatures of the first thermal power process are given as about 900 to 950°C, those of the second as 450 to 550°C. The heat consumption for the fuel conversion will be covered primarily by the first thermal power process and will occur at > 10 bars. Further claims contain the possibilities of circuit direction, the use of different heat sources, as well as the utilization of the energy gained.

**21468 Mechanism of corrosion of waterwalls when burning oil of high sulfur content.** Ernest, A.K.; Tsirul'nikov, L.M. *Therm. Eng. (USSR) (Engl. Transl.);* **22**: No. 11, 50-53(Nov 1976).

Translated from Teploenergetika; 22: No. 11, 45-48(Nov 1975).

The role of high-sulfur content fuels in the corrosion of supercritical steam generators is discussed. The part played by $SO_2$ in high temperature corrosion is specifically considered. However, it is concluded that $SO_2$ cannot destroy the oxide film and, therefore, its effect on high temperature corrosion is quite small. It is only at points where no oxygen is present that $SO_2$ can, to some extent, speed up the formation of FeS whereupon $SO_2$ no longer affects the rate of corrosion. (RCK)

**21469 Proceedings of the 1975 IEEE conference on decision and control.** Piscataway, NJ; IEEE, Inc. (1975). 896p. (CONF-751266—).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

Papers are presented on seismic data processing, economics optimization theory, estimation, algebraic systems, remote handling, systems education, environmental problems, optimal control, linear systems, flight control, digital imagery power systems, large scale systems, transportation systems, computational methods, highway traffic systems, and adaptive systems. A separate abstract was prepared for each of fourteen papers. (JRD)

**21470 Control interfaces of generation allocation of the large interconnected power system.** Zaborszky, J.; Subramanian, A.K.; Lu, K.M. (Washington Univ., St. Louis). pp 283-302 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

The systemwide generation allocation problem is defined and its customary subdivisions, geographical, hierarchical, modal and functional are identified. Functional areas of control action are noted and the control practices within these areas and especially on the interfaces are observed and discussed. The necessity, progress and potential direction of a rethinking of the interfaces and their control are discussed.

**21471 Security constrained optimization for power systems.** Debs, A.S. (Georgia Inst. of Tech., Atlanta). pp 303-308 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Secure power system operation is obtained, to a large extent, by on-line monitoring of the system assessing its security, and providing control action to improve its security level. Traditionally, the economy of system operation was the overriding factor. By combining economy with security, the problem becomes quite complex from the points of view of methodology of security assessment; overall objectives of system optimization; and computational feasibility for on-line analysis. An overview of the application of optimization theory to this problem is examined. A critical analysis of a selected subset of methodologies is provided.

### COOLING AND HEAT TRANSFER EQUIPMENT AND SYSTEMS

*REFER ALSO TO CITATION(S) 21523*

**21472** (COO/4188—2) **Federal role in dry and wet-dry cooling tower research, development, and demonstration.** (Donovan, Hamester and Rattien, Inc., Washington, D.C. (USA)). Sep 1977. Contract EN-77-C-02-4188. 72p. Dep. NTIS, PC A04/MF A01.

It is concluded that it is appropriate for the Energy Research and Development Administration (or its successor) to sponsor a program of fiscal, technical and management support directed at providing a commercial advanced concept wet/dry (or dry) cooling technology for electric utility use within ten years. This federal role is thought to be appropriate for several reasons, including: the need for such technology, although expected to grow only slowly at first, will eventually be quite widespread; wet/dry and dry cooling tower technology is currently available, but successful development of an advanced concept should produce significant cost savings for this component of power plant costs; established cooling tower vendors do not appear to have sufficient research dollars available to support a program of the magnitude planned by ERDA, although at least one non-vendor advanced concept development project is underway; the Electric Power Research Institute (EPRI), the State of

California and potentially other entities have expressed a willingness to support the ERDA program with significant funds, but state that they cannot assume complete funding at this time; and even without the shared funding mentioned above, the ERDA program is expected to produce discounted public and/or private industry benefits in excess of its costs.

**21473** (N—77-26628) **Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report.** Beecher, D.T. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 1 Nov 1976. Contracts NAS3-19407;E(49-18)-1751. 497p. (NASA-CR—134942(Vol.1); REPT—76-9E9-ECAS-R2(Vol.1)). NTIS PC A21/MF A01.

A parametric analysis of energy conversion concepts using coal or coal derived fuels is presented. Conceptual plant designs were formulated for three advanced power conversion concepts; (1) a combined gas steam turbine cycle whose gas turbines are air cooled, and burn a low Btu gas from coupled pressurized fluidized bed gasifiers, (2) a combined gas steam turbine cycle whose gas turbine expanders contain ceramic elements and burn a semiclean coal derived liquid from the H coal process, and (3) an advanced steam plant whose steam is pressurized fluidized bed boilers. A detailed analysis of performance, plant layout, capital cost, cost of electricity, natural resource requirements, and emissions of the three advanced concepts is also included.

**21474** (N—77-26630) **Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report.** Beecher, D.T. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 1 Nov 1976. Contracts NAS3-19407;E(49-18)-1751. 398p. (NASA-CR—134942-V-3; REPT—76-9E9-ECAS-R2-V-3). NTIS PC A17/MF A01.

For abstract, see N77-26631.

**21475** (N—77-26631) **Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report.** Corman, J.C.; Fox, G.R. (General Electric Co., Schenectady, N.Y. (USA)). Dec 1976. Contracts NAS3-19406;E(49-18)-1751. 54p. (NASA-CR—134949-V-1; SRD—76-064-1-V-1). NTIS PC A04/MF A01.

A data base for the comparison of advanced energy conversion systems for electric utility baseload applications using coal or coal-derived fuels was developed. Conceptual designs were developed for seven systems to permit estimates of power plant efficiency, capital cost, environmental intrusion characteristics, natural resource requirements, and cost of electricity at an assumed capacity factor of 65%. The systems studied were advanced steam with atmospheric fludized bed (AFB) and pressurized fluidized bed (PFB) heat input subsystems, a closed helium gas turbine (organic bottoming) with an AFB, a potassium topping cycle with a PFB, a combined cycle gas turbine--water cooled--burning a coal-derived liquid fuel, a combined cycle gas turbine--air cooled--integrated with LBtu gasification, and an open cycle MHD system. An emissions limit target was specified for the power plant conceptual designs. A steam power plant (3,500 psig/1000 F/1000 F) with a coal-burning radiant furnace and a wet lime stack gas scrubber (stack reheat to 250 F), analyzed in a study using the same groundrules as ECAS, were used as references for comparison. All of the systems exhibited an estimated efficiency better than the 32% reference case. Five of the systems showed a lower cost of electricity than the 39.8 mills/kWh reference case. Development plans and cost estimates were prepared for the energy conversion portion of the respective systems. An implementation assessment was performed to estimate the potential applicability of the advanced energy conversion systems in electric utility generation systems.

**21476** (N—77-26632) **Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report.** Corman, J.C.; Robertson, A.S.; Stewart, R.D.; Cassel, T.A.V.; Johnson, G.G. (General Electric Co., Schenectady, N.Y. (USA)). Dec 1976. Contracts NAS3-19406;E(49-18)-1751. 97p. (NASA-CR—134949-V-2-PT-1; SRD—76-064-2-V-2-PT-1). NTIS PC A05/MF A01.

For abstract, see N77-26631.

**21477** (N—77-26633) **Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report.** Brown, D.H.; Pomeroy, B.D.; Shah, R.P. (General Electric Co., Schenectady, N.Y. (USA)). Dec 1976. Contracts NAS3-19406;E(49-18)-1751. 274p. (NASA-CR—134949-V-2-PT-2; SRD—76-064-2-V-2-PT-2). NTIS PC A12/MF A01.

For abstract, see N77-26631.

**21478** (N—77-26634) **Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. Part 3: open cycle gas turbines and open cycle MHD. Final report.** Harris, L.P.; Shah, R.P. (General Electric Co., Schenectady, N.Y. (USA)). Dec 1976. Contracts NAS3-19406;E(49-18)-1751. 277p. (NASA-CR—134949-V-2-PT-3; SRD—76-064-2-V-2-PT-3). NTIS PC A13/MF A01.

For abstract, see N77-26631.

**21479** (N—77-26635) **Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems: conceptual designs. Part 4: summary of results. Final report.** Brown, D.H.; Corman, J.C.; Johnson, G.G.; Macfarland, W.J.; Pomeroy, B.D. (General Electric Co., Schenectady, N.Y. (USA)). Dec 1976. Contracts NAS3-19406;E(49-18)-1751. 92p. (NASA-CR—134949-V-2-PT-4; SRD—76-064-2-V-2-PT-4). NTIS PC A05/MF A01.

For abstract, see N77-26631.

**21480** (N—77-26636) **Energy conversion alternatives study (ECAS), phase 2. Volume 3: research and development plans and implementation assessment. Final report.** Bass, R.R.; Brown, D.H.; Corman, J.C.; Harris, L.P.; Pomeroy, B.D. (General Electric Co., Schenectady, N.Y. (USA)). Dec 1976. Contracts NAS3-19406;E(49-18)-1751. 347p. (NASA-CR—134949-V-3; SRD—76-064-3). NTIS PC A15/MF A01.

For abstract, see N77-26631.

**21481** (ORNL-tr—4519) **Water supply for thermal and atomic electrical power stations and water conservation.** Minasyan, R.G. 1977. Translation of E/CONF-70/TP-121. (CONF-770389—1). 31p. Dep. NTIS, PC A03/MF A01.

From United Nations conference on water resources; Mar de Plata, Argentina (14 Mar 1977).

The problems associated with providing water supplies for fossil-fuel, nuclear, and dual-purpose power plants planned for construction in the USSR are discussed. These problems include water availability effects on power plant siting, water losses during power generation, environmental effects of thermal discharges from cooling systems, operation of recycling cooling systems, and the surface water pollution aspects of power plant operations. Studies which will be pursued in the USSR to reduce or eliminate the adverse effects of power plants on surface waters are listed. (LCL)

## POWER CYCLES

**21482** (TID—27939) **Coal fired combined cycle for electric power generation.** Brooks, R.D.; Peterson, J.R.; Weth, G. (General Electric Co., Schenectady, N.Y. (USA); Energy Research and Development Administration, Washington, D.C. (USA). Office of Fossil Energy). 1977. Contract EX-76-C-01-2357. 28p. Dep. NTIS, PC A03/MF A01.

The coal-fired combined cycle (CFCC) is a unique power plant concept which when developed will provide a direct coal-burning gas turbine and steam turbine combined cycle suitable for base load application. The combined cycle operation offers the potential for improved efficiency, and pressurized fluidized bed combustion will provide substantial improvements in lowering the emissions of coal-burning plants for the electric utility industry. The CFCC approach provides cooling of the fluid bed combustor through the use of steam tubes in the bed which supply high pressure, high temperature steam to a conventional steam turbine-generator. Combustion gases are expanded through heavy duty gas turbines which pressurize the combustor and generate additional electric power.

**21483** **Development of the combined gas-steam turbine power plants.** Meyer-Kahrweg, H. *Energie;* **29**: No. 7, 227-231(Jul 1977). (In German).

A review of the latest achievement in the design and manufacture of turbines that may use gas or steam for driving generators in power plants is given. The so-called Lurgi-process is used for gasification of coal.

## COMPONENTS

*REFER ALSO TO CITATION(S) 20928, 21519*

**21484** (CONF-770658—, pp 125-148) **In-plant coal and ash handling overview.** DeCarlo, J.A. Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Materials handling is described in sections on coal handling, stokers, and ash handling. Schematics and diagrams of handling systems are included. (JRD)

**21485** (FE—2292-9) **Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan.** Carlson, N.G. (United Technologies Corp., Farmington, Conn. (USA). Power Systems Div.). Nov 1977. Contract EX-76-C-01-2292. 84p. Dep. NTIS, PC A05/MF A01.

As part of the Phase 1 program effort, a definition has been made of the Technology Development Plan for the Phase 2 program. The objective of Phase 2 is to obtain the technical data necessary to update the design system in order to enable preparation of final designs for the Phase 3 technology verification test. The planned program will involve a two year effort and consist of thirteen individual program tasks. The main areas of work are associated with the turbine and combustor subsystems. However, the scope of work also includes developing gas cleanup technology, power turbine technology, and a test program plan for Phase 3.

**21486** (NP—22768) **Possibilities of early detection of failures in steam turbines by evaluating the temperature transmitting behavior of component groups and its correlation with defective variations.** Breitkopf, G. (Karlsruhe Univ. (TH) (Germany, F.R.). Fakultaet fuer Maschinenbau). 22 Jan 1976. 97p. (In German). NTIS (US Sales Only), PC A05/MF A01.

Thesis.

Possibilities for the early detection of defects in steam turbines arising from observation of the local temperature transmitting behavior in the interior of the turbine were investigated. Single components or component groups may be considered as temperature transmitting systems. A number of variations, i.e., damage, lead to changes in the transfer function. This function may, therefore, serve as a characteristic function for monitoring the components considered.

**21487 Extension of the power plant mehrum by an additional 700 MW unit.** *Energie;* **29**: No. 7, 221-226(Jul 1977). (In German).

Design data are given for a turbine-generator set under construction, for the Hannover utility company. This unit has a coal-fired boiler and has air cooling towers.

**21488 Design analysis of thermal and hydrodynamic characteristics of a vertical once-through steam generator with the unit capacity of 500 MW (el.).** Godik, I.B.; Afanas'ev, B.P.; Mirgorodskii, I.S. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 4, 38-43(Apr 1977). (In Russian).

The design of a projected new vertical once-through steam generator is described. The steam generator is essentially a vertical single-shell heat exchanger comprising the following main elements: a shell with a system of water inlet and steam outlet connections, air vents and drains; a central collector with water distributing arrangements, inlet and outlet connections of the primary heat carrier; a system of tubes consisting of two heat exchange bundles (top and bottom) formed by concentric layers of spirally coiled tubes 12x1.2 mm diam, made of steel EP-350, 14 m long. Its characteristics are as follows; steam pressure 64 kgf/cm$^2$; steam temperature 315°C; feedwater temperature 220°C; steam output capacity 2850 t/h; first loop heat carrier pressure 160 kgf/cm$^2$; heat carrier temperature; inlet 326°C, outlet 285°C.

**21489 Dynamic characteristics of the P-49 steam generator for a 500 MW power block.** Manicyev, O.D.; Gorskii, E.R.; Smetanina, V.I. *Teploenergetika (Moscow);* No. 4, 64-69(Apr 1977). (In Russian).

Material is presented concerning the investigation of experimental dynamic characteristics of the supercritical pressure steam generator P-49 of a 500 MW power unit. They have been determined for the average load on the unit amounting to 355 to 360 MW.

**21490 Segmental radial bearings for high-capacity turbines.** Kosyak, Yu.F.; Vishnevetskii, M.G. (Khar'kov Turbogenerator Plant, Ukr SSR). *Teploenergetika (Moscow);* No. 4, 72-74(Apr 1977). (In Russian).

Designs of segmental radial bearings developed at Kharkov Turbogenerator Works are presented and results of their tests on special setups are discussed. These bearings are envisaged for 500 MW turbines. The effects of loads, method of lubrication, frequency of rotation, flow rate and temperature of the lubricant, quantity and location of segments, form of turning of the bearings, mounting gaps, lubricant pressure before the bearing, the shape of the oil-receiving chamber of segments are investigated. It is concluded that use of segmental bearings will permit reduction of losses in radial bearings and improve turbine lubrication.

**21491 Method of optimal design of axial turbine stages.** Boiko, A.V.; Govorushchenko, Yu.N. (Khar'kov Polytech Inst, Ukr SSR). *Teploenergetika (Moscow);* No. 4, 76-79(Apr 1977). (In Russian).

A method of optimal design of the last (or single) axial turbine stages is proposed. Taking account of the three-dimensional flow of fluids in a stage, it permits determination of the best (from the point of view of maximum efficiency) laws of radial distribution of the stator-leaving flow angles, the degree of reactivity, the leaving flow angles, and the distribution of the axial flow component by the height of the stage after the rotor. Calculation results are in qualitative agreement with experimental data.

**21492 Present-day problems of boiler engineering.** Parshin, A.A.; Khristich, L.M. *Teploenergetika (Moscow);* No. 3, 2-4(Mar 1977). (In Russian).

The most important problems of boiler engineering to meet the future needs of the USSR are outlined. They are: designing extra high-capacity solid fuel-fired boilers, above all for burning Kansk-Achinsk, Ekibastuz, Kuznetsk, and Donbas grades of coal, designing highly maneuverable equipment, reduction of air pollution, construction of giant energy complexes in the eastern parts of the country. Some project design work carried out in this respect by the "Krasnyi Kotelshchik" Boilermaking Plant in Taganrof is described.

**21493 Specific features of starting operating conditions of a TGMP-324 gastight boiler of a 300 MW monoblock.** Shmukler, B.I.; Livshits, M.A.; Vavilin, A.N.; Glusker, B.N.; Ivanov, N.V.; Mikhailov, S.Ya.; Nosov, B.N. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 3, 4-7(Mar 1977). (In Russian).

Results of an experimental investigation are presented regarding the starting operating conditions of a 300 MW monoblock with a TGMP-324 gastight boiler. The boiler is equipped with a recirculation loop in the furnace waterwalls. The reliability of the starting operating conditions for any firing feedwater flowrate (from 0 to 30% of the related discharge) is demonstrated. An analysis of the heating rate of the boiler waterwall system is carried out and it is shown that the only means for speeding up the kindling operation is overforcing the furnace.

**21494 Investigation of slightly nonisothermal models of recirculation of gases into the top part of furnace chambers of high-capacity boilers.** Temirbaev, D.Zh.; Belilovskii, Yu.B. (Alma-Ata Power Eng Inst, Kaz SSR). *Teploenergetika (Moscow);* No. 3, 11-15(Mar 1977). (In Russian).

Results are set forth of a slightly nonisothermal investigation of aerodynamic conditions of the introduction of recirculation gases into the top part of boiler furnace chambers of high-capacity power units. It is shown that variation of the excess temperature along the jet paths is the more intensive, the wider is the relative spacing and the lower the hydrodynamic parameter. With an increase in relative spacing, the mixing of the jet system with the stream in the channel improves, approaching the intensity of mixing of a single jet with an limitless grazing stream.

**21495 Some problems of control of intermediate superheating of steam.** Reznik, V.I.; Shleifer, B.M.; Zaraiskii, S.I. *Teploenergetika (Moscow);* No. 3, 15-19(Mar 1977). (In Russian).

Problems of selection of the method of control of intermediate superheating of steam are considered. A concrete comparison is made between intermediate steam superheating control by gas recirculation into the bottom part of the furnace and by additional water injection into the intermediate superheater on the one hand and control by means of gas recirculation into the bottom part of the furnace and by means of steam/steam heat exchangers on the other. The comparison is made by taking as an example the gas and fuel oil-fired boiler of a 300 MW power plant.

**21496 Combustion of anthracite in the furnace chamber of a TPP-210 boiler with drying agent feeding through the top tier of principal burners.** Shnitser, I.N.; Yur'ev, L.V.; Shapovalov, Yu.I.; Plaksin, O.T. (Cent Sci Res Boiler and Turbine Inst, USSR). *Teploenergetika (Moscow);* No. 3, 19-24(Mar 1977). (In Russian).

It is shown that, in order to improve air conditions and the operation of a TPP-210 boiler when burning anthracite, it is advantageous to supply the drying agent to the furnace through the top tier of the principal burners. 12 refs.

**21497 Investigation of the efficiency of the low pressure cylinder of the K-200-130 turbine manufactured by the Leningrad Metal Works prior to and after modernization.** Marchenko, Yu.A.; Khrabrov, P.V.; Rozenberg, S.Sh.; Sandovskii, V.B.; Efimov, A.I.; Sorokin, N.A. (Cent Sci Res Boiler and Turbine Inst, USSR). *Teploenergetika (Moscow);* No. 3, 46-51(Mar 1977). (In Russian).

Results of a gasdynamic investigation of the flow-through part of the low pressure cylinder, with a one-and-a-half exhaust, of the K-200-130 turbine, prior to and after modernization, are presented. Based on the results of gasdynamic measurements, an analysis of the causes of improved efficiency of the flow-through part of the low pressure cylinder after modernization is given.

**21498 Thermally stressed state of rotors in end seal zones of the T-100-130 turbine in steamless operating conditions.** Lyudomirskii, B.N.; Tazhiev, E.I.; Grachev, V.A.; Lesnichenko, A.Ya. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 3, 54-58(Mar 1977). (In Russian).

Results are presented of an experimental investigation of the thermal state of the front end seal of the high-pressure cylinder and the medium-pressure cylinder of the T-100-130 turbine in steamless operating conditions. Relying on experimental data, an evaluation of the permissible number of changeovers of this turbine to steamless operatng conditions, limited by the medium pressure rotor, is carried out. Recommendations are given on reducing rotor cooling-down by means of feeding compressing deaerated steam under steamless con-

ditions of operation, thus ensuring a reliable work of the turbine under these conditions.

**21499 Results of tests of a prototype of the PE-600-300-2 feedwater pump.** Gusti, I.P. (ORGRES, USSR). *Teploenergetika (Moscow);* No. 3, 61-64(Mar 1977). (In Russian).

Results of tests of a prototype of the PE-600-300-2 feedwater pump integrated into a 300 MW monoblock are presented. Performance indices of the pump and the pump unit are presented, they are compared with the rated data and with the results of the PE-600-300 pump units. The tests show that, practically speaking, the head pressure characteristics of the PE-600-300-2 feedwater pump coincide with the rated ones within the range of the investigated operating conditions.

**21500 Equation of state of water and steam for computer aided calculation of processes and equipment of power plants.** Rivkin, S.L.; Kremenevskaya, E.A. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 3, 69-73(Mar 1977). (In Russian).

Equations are presented which describe thermodynamic properties of water and steam in the region of the parameters of state important in practice for steam turbine engineering. These equations are in agreement with the presently valid standards and have an accuracy which meets the requirements of thermal engineering calculations.

**21501 Results of thermal tests of the prototype of the type t-250/322-240 turbine set made by the urals turbomachinery plant.** Greil', A.D.; Sakharov, A.M. (ORGRES, USSR). *Teploenergetika (Moscow);* No. 2, 2-6(Feb 1977). (In Russian).

Principal results of the T-260/300-240 turbine set tests are presented. This is a four-cylinder single-shaft turbine with the rated steam parameters of 24.5 MPa (240 kg/cm$sup 2$) and 540/540$degree$C. It has 10 steam takeoffs for regeneration and for a feedwater turbopump, including a controlled takeoff for district heating up to 384 MW (330 Gcal/h). The test results given in tables show that the manufacturer's guarantees have been kept, without counting tolerance, with an average underconsumption in district heating modes by 2.5%. However, owing to poor seals and other losses, the efficiency of the turbine is found to be somewhat lower than expected.

**21502 Control system of the T-250/300-240 steam turbine.** Rabinovich, A.V.; Man'kin, M.N.; Trigolos, G.S.; Ivashev, V.D.; Zolotarev, A.A.; Lesnov, V.A.; Ivanov, S.N.; Samarenko, V.N. (OGRES, USSR). *Teploenergetika (Moscow);* No. 2, 6-13(Feb 1977). (In Russian).

Principal characteristics of the control diagram of the turbine are given. A brief description of the design of the aautomatic control system assemblies is given and the results of tests and adjustment of the prototype carried out at the TETs-22 Mosenergo heat-and-power plant in Moscow are presented.

**21503 Analysis of nonstationary processes in saturated steam turbine flow-through sections.** Deich, M.E.; Kostyuk, A.G.; Saltanov, G.A.; Filippov, G.A.; Kukushkin, A.N.; Simanovskii, G.P. (Moscow Power Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 25-31(Feb 1977). (In Russian).

Results of an experimental and theoretical analysis of unsteady flow of condensing steam in various elements of flow-through turbine sections are presented. The purpose of the work is to consider one of the probable causes of generation of additional unsteady pulsations of flow parameters, namely spontaneous steam condensation with stepwise heat addition in transonic flow regions. It is concluded that wet steam calls forth specific disturbances which may lead to vibrations of nozzle blades. A method is worked out permitting determination of the amplitudes and frequencies of these disturbing forces. To prevent fracturing of the trailing edges of blades, they must be detuned from disturbing impulses of nonstationary condensation. 23 refs.

**21504 Formation of coarsely dispersed moisture on the trailing edges of nozzle rings of saturated steam turbines.** Abramov, Yu.I.; Silin, A.V. (Univ Patrisa Lumumba, Moscow, USSR). *Teploenergetika (Moscow);* No. 2, 31-35(Feb 1977). (In Russian).

The mechanisms of formation of droplet moisture on the trailing edges of nozzle blades are considered. The dependence of the dispersion on the geometric parameters of the cascade and the parameters of the flow operating conditions is investigated. It is shown that the smallest dimensions of the trailing edge moisture particles are characteristic of blades with sharp edges.

**21505 Profile losses in unsteady flow past active rotor blades.** Samoilovich, G.S.; Yablokov, L.D.; Rabotaev, V.G. (Moscow Energet Inst, USSR). *Teploenergetika (Moscow);* No. 2, 40-42(Feb 1977). (In Russian).

The effect of periodic unsteadiness on profile losses in an active cascade of rotor blades is investigated on a reversed model of a turbine stage. The nozzle ring is replaced by a cascade of round cylindrical bars. Quantitative evaluation of the increase of profile losses depending on some parameters deriving transition from uniform to unsteady flow are obtained.

**21506 Determination on a static model of the stiffness factor of the transverse circulation force in steam turbines.** Rzheznikov, Yu.V.; Boitsova, E.A.; Kuz'menko, O.A. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 42-47(Feb 1977). (In Russian).

A method is worked out for the determination on a static model and conversion to natural-size conditions, of the stiffness coefficient of the transverse circulation force which contributes to the generation of low-frequency vibrations of high-capacity steam turbines.

**21507 Investigation of the transient conditions of operation of the GT-100-750-2 gas turbines.** Ol'khovskii, G.G.; Ostrovskii, S.A. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 47-52(Feb 1977). (In Russian).

Transient operating conditions of the GT-100-750-2 gas turbine plant are analyzed in detail with the aid of nomograms of thermal characteristics of gas turbine plants, calculated by means of a computer. Operation of the gas turbine plant, depending on the opening of fuel valves, is considered and the possibilities of control of the plant are evaluated.

**21508 Improvement of the reliability of waterwall superheater of the tpp-110 steam generators.** Lokshin, V.A.; Przhiyalkovskii, M.M.; Taldykin, K.M.; Gladilin, V.I. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 52-55(Feb 1977). (In Russian).

Relying on industrial tests of the superheater of the TPP-110 steam generators, it is shown that, after the installation of an additional output convective stage, the reliability of operation of superposed waterwall superheater heating surfaces improved considerably. In order to reduce hydraulic maladjustments, recommendations are given on improving the hydraulic diagram of connection of waterwalls and of coiled tubes within waterwalls.

**21509 Optimalizing control of firing conditions in the furnace of drum-type steam generators.** Pletnev, G.P.; Safonov, V.M.; Usanov, V.V. (Moscow Power Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 57-62(Feb 1977). (In Russian).

Shortcomings of the automatic control of air feeding into coal-fired boiler furnaces according to "fuel-air" or "heat-air" schemes are considered. To eliminate them, a system with an extremal controller using an indirect efficiency signal, namely pressure drop in the circulation loop, is proposed. This signal has low inertiality, is proportional to the heat emission in the furnace, and has a clearly marked extremal static characteristic, depending on the air flowrate within a wide range of steam loads. Results of tests of the control system under laboratory and industrial conditions are presented.

**21510 Investigation of conditions of operation of low-pressure sections of T-50-130 turbines with reduced ventilation steam passes.** Shapiro, G.A.; Zakharov, Yu.V. (Kirov Polytech Inst, USSR). *Teploenergetika (Moscow);* No. 2, 22-25(Feb 1977). (In Russian).

Results of investigations of the dependence of the capacity of the low-pressure section stage on steam flowrate under low-volume steam conditions of operation are presented. The possibility of operation of low-pressure section stages with ventilation steam passes reduced to one third in volume and economic expendency of such a mode of operation are demonstrated.

**21511 Voltage and reactive production programming in an electric system. II. Notes on mathematical models of generators and loads.** Capasso, A.; Carrus, A.; Mariani, E.; Sabelli, C. (Univ di Roma, Italy). *Energ. Elettr.;* No. 5, 234-243(1977). (In Italian).

The paper discusses the problem of generator and load representation in calculation processes to study the programming of voltage and reactive power production. An analysis is developed of mainly qualitative character on the influence of simplifications that may be effected to determine the generator utilization diagrams (and therefore in their representation in calculation process) with regard to saturation and anisotropy of magnetic circuits. The influence on the results of the process type (analytic or graphic) used to determine the diagrams is studied. A theoretical simplified treatment of the synchronous machine is given in the Appendix. A section of the paper concerns the problem of the representation of load dependence on the voltage.

**21512 Boiler conservation during stoppages.** Dutray, G.; Teraube, R. (Ste Fives-Cail Babcock, Fr). *APAVE Rev.;* **58**: No. 199, 35-42(1977). (In French).

A systematic presentation is given of the procedures designed to ensure boiler conservation during periods of stoppage.

**21513 Fabrication and reliability of welded process plant. Volume I. Papers.** Cambridge, England; Welding Institute (1977). 239p. (CONF-761191—).

From Conference on fabrication and reliability of welded process plant; London, UK (16 Nov 1976).

Papers are grouped under the headings tube-to tubeplate welds, welding heat- and corrosion-resistant materials, fabrication techniques, failure under dynamic loading, and quality assurance in safety. Separate abstracts were prepared for two papers.

**21514 Performance of tube-to-tubeplate welded joints in high pressure feed heaters.** Levene, L.H. pp 21-27 of In Fabrication and reliability of welded process plant. Volume I. Cambridge, England; Welding Institute (1977).

From Conference on fabrication and reliability of welded process plant; London, UK (16 Nov 1976).

See CONF-761191—.

As an extensive user and purchaser of welded process plant the CEGB has always closely collaborated with industry in the design and manufacture of critical features of the plant. An account is given of such collaboration with six feed water heater makers in the development of their designs, fabrication methods, and quality control systems for tube-to-tubeplate welding. Reliable service experience of this feature in the high pressure feed heaters of large turbogenerating units over a period of years has confirmed the selection of the Foster Wheeler butt welded joint for power station operation. Details are included of the various makers' contribution to the successful performance of the joint in thirteen stations containing 500 and 660MW units.

**21515 Investigation of the hydrodynamics of two-phase flow with nonuniform supply of vapor over the cross section.** Dement'ev, B.A.; Skachek, M.A.; Alkhutov, M.S. (Moscow Power Inst.). *Therm. Eng. (USSR) (Engl. Transl.);* **22**: No. 11, 62-65(Nov 1976).

Translated from Teploenergetika; 22: No. 11, 55-59(Nov 1975).

**21516** (DOE-tr—30) **On heat transmission in radiation combustion chambers by heaters.** Bammert, K.; Rehwinkel, H. Translated from *Konstr. Masch., Appar. Geraetebau;* **26**: No. 1, 2-8(1974). 13p. Dep. NTIS, PC A02/MF A01.

When designing boiler plants, the accurate preliminary computation of heat transmission into the combustion chamber is especially important. Tests for determining heat transmission in the overhead-fired combustion chamber was carried out on a comprehensively designed special boiler having the heater of a closed gas turbine fired by blast furnace gas and fuel oil EL. The dependency of the total heat absorption on the energy ratio between gas and oil, on the air factor and on the load is discussed. The radiation law of Stefan-Boltzmann was used for the recomputation. The radiation factors are determined which are to be used for reproduction of test results. The results are transferable to similar combustion chambers of heaters and steam generators. Therewith, the reliability is improved in measurement of combustion chamber dimensions and design of cooling surfaces.

## WASTE HEAT UTILIZATION

**21517 Waste energy source utilization circuit and method.** Wilkerson, A.W. US Patent 4,059,772. 22 Nov 1977. Filed date 27 Feb 1976. 24p.

A switching circuit, typically a thyristor bridge, is connected to a source of waste energy. The source can be waste energy occurring as a by-product of man's activities such as waste heat energy, stored water, or the potential mechanical energy of elevated objects. The source provides dc power either directly or through conversion. The switching circuit is also connected to an ac load and across ac power mains energizing the load. The switching circuit is operable to periodically connect the waste energy source to the ac load in a power supplying manner. The ac mains impart suitable voltage and frequency characteristics to the electrical power so supplied. In the event the supplied power exceeds the power required by the ac load, the difference is taken by the ac power mains.

**21518 Design and experience in the operation of the Danziger Strasse gas- and oil-fired thermal Power Plant of the Oberhausen Power Supply Company.** Pluer, R. (Energieversorg Oberhausen, Ger). *VGB Kraftwerkstech.;* **57**: No. 8, 519-526(Aug 1977). (In German).

The thermal power station I of the Oberhausen Power Supply Company dates from 1899 and since 1960 has been supplying an essential part of the heating requirements of the city of Oberhausen through a district power/heating system by means of an associated gas turbine. In 1970 the thermal power station was enlarged by the addition of a back-p ressure turbine and now supplies the bulk of the city's district heating requirements, as a result of which only during certain very infrequent peak periods is it necessary to generate fresh heat.

**21519 Combined gas/steam-turbine power station belonging to the Stadtwerke Saarbruecken AG.** Flad, J. (Stadtwerke Saarbruecken, Ger). *Fernwaerme Int.;* **6**: No. 3, 106-112(Jun 1977). (In German).

By connecting a waste-heat boiler on the outlet side, through which the waste gases from a gas turbine are passing, the relatively unsatisfactory efficiency of the gas turbine can be considerably improved if there is a requriement for the steam generated in the waste-heat boiler. The connection of a gas turbine or the waste-heat boiler makes it possible to generate as much heat or electrical energy which is required for operation at the particular moment. The article describes in detail this "combined gas/steam-turbine installation" in which the gas turbine and the steam turbine work for a common generator.

## ECONOMICS

*REFER ALSO TO CITATION(S) 21739, 21740*

**21520 Is the development of large power plant units reasonable.** Buch, A. *Energie;* **29**: No. 7, 198-204(Jul 1977). (In German).

The decision on the size of the power plant blocks to be erected is influenced by problem of site selection, constructive aspects and requirements of environmental protection. It is shown that large power blocks work about 10% more economically than smaller blocks. The numerous influencing factors (e.g. duration of utilization, block power, area required) are examined with the cost price of electricity.

## OFF-PEAK ENERGY STORAGE

*REFER ALSO TO CITATION(S) 21746*

**21521 Off-peak energy storage concept for electric utilities: Part I. Electric utility requirements.** Sulzberger, V.T. (Public Service Electric and Gas Co., Newark, NJ); El-Badry, Y.Z.; Clifford, J.E.; Brooman, E.W. *Appl. Energy;* **3**: No. 3, 167-188(Jul 1977).

The water battery, a reversible water electrolyzer device was evaluated in an analytical and conceptual design study as a load-levelling system for an electric utility. During periods when off-peak electrical power was available, the water battery would produce hydrogen and oxygen by electrolysis of water; during peak demand periods the water battery would be operated in the reverse mode, functioning as a fuel cell by producing electrical power through the recombination of the oxygen and hydrogen held in its storage vessels. The analysis involved characterization of the PSE and G system demand requirements now and in the future, its current off-peak energy availability, the typical sizing and placement of energy storage units and the approximate break even economics and potential advantages to the utility of a water battery energy storage system. In the economic analysis, the water battery was compared with the gas turbine and the fuel cell for cost effectiveness in meeting peak and intermediate power demands, respectively. Compared with a "reformer-type" fuel cell (costed at $300/kW for intermediate duty) the break even capital cost of a 50% efficient water battery would be $100/kW plus about $200/kW for each increase of $1/10$^6$ Btu above the reference cost of $1/10$^6$ Btu for fossil fuel. The available margin would increase about $50/kW for each decrease of 1 mill/kWh in off-peak energy cost below the reference cost of 8 mills/kWh. In a similar comparison with the gas turbine (costed at $135/kW) for peaking duty, the break even cost of a 50% efficient water battery would be $100/kW. The break even cost could rise about $100/kW for each increase in fossil fuel cost of $1/10$^6$ Btu and about $20/kW for each decrease in off-peak energy cost of 1 mill/kWh.

## FUELS

*REFER ALSO TO CITATION(S) 20919*

**21522** (CONF-771024—3) **Modifications and costs of converting to low sulfur western coals.** Reddy, G.N.; Krohm, G.C. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 19p. Dep. NTIS, PC A02/MF A01.

From NCA/BCR coal conference; Louisville, KY, USA (19 Oct 1977).

It thus appears that the conversion of existing boilers burning high sulfur Midwestern coals to low-sulfur Western coals is not a simple matter. The difficulties of burning this fuel can be traced to the inherent problems of operating the boiler outside of its designed operating limits. The operating parameters that are affected by coal characteristics are summarized below. These factors must be considered carefully when planning conversion of a power plant to burn Western coal: Excessive dusting of coal enroute to power plant. Reduced conveyor belt capacity (10-20%). Decreased pulverizer output (up to 35%). Loss of boiler efficiency due to increased moisture (up to 30%). Water side scale buildup due to decreased slagging. Increased fouling with high sodium coal. Larger dust handling system requirements within the boiler. Carbon carryover. Decreased electrostatic precipitators efficiency because of the decrease in sulfur trioxide concentrations in the flue gases. Even

though the scope of this paper does not include a detailed evaluation of the reduction in electrostatic precipitator collection efficiency, this has been identified as one of the major problems. Cost of electricity generated per kWh may increase up to 51% depending upon the extent of boiler modifications and increases in operating and maintenance costs.

## ENVIRONMENTAL ASPECTS

*REFER ALSO TO CITATION(S) 20935, 21545, 21743, 22196, 22216, 22227*

### THERMAL EFFLUENTS

*REFER ALSO TO CITATION(S) 21481*

**21523 Effect of heated water discharge on oxygen content in the water supply source of thermal power plants.** Berman, L.D. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 3, 64-67(Mar 1977). (In Russian).

It is shown that at thermal power plants with direct-flow water supply and a circulatory system of water supply with a cooling reservoir, the heating of the cooling water in turbine condensers does not result in practice in the loss of oxygen contained in water taken from the water supply source. A substantial loss of oxygen contained in the cooling water is possible if it flows along a long open discharge channel. This loss of oxygen is compensated to a considerable extent by aeration of water on a spillway. If necessary, spillways whose design intensifies aeration may be employed. Decrease in the concentration of oxygen that is sometimes observed, is not caused by the heating of water in the source alone but by the increased effect of other factors, namely discharge of great quantities of pollutants into water.

### NOXIOUS GAS AND PARTICULATE ABATEMENT AND CONTROL

*REFER ALSO TO CITATION(S) 20890, 20899, 20900, 20901*

**21524** (CONF-7710101—3) **Capital and operating costs of particulate control equipment for coal-fired power plants.** Farber, P.S. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 18p. Dep. NTIS, PC A02/MF A01.

From 5. national conference on energy and the environment; Cincinnati, OH, USA (31 Oct 1977).

Initial models are developed for relating performance to the capital and operating costs of particulate control equipment. These models indicate that, unless also used for sulfur oxide collection, scrubbers are not economical compared to electrostatic precipitators or baghouses. It has also been found that, depending upon the sulfur content of the coal being burned and the collection efficiency required, fabric-filter baghouses and electrostatic precipitators have comparable operating costs.

**21525** (PB—269850) **TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January—September 1976.** Holliden, G.A.; Robards, R.F.; Moore, N.D.; Kelso, T.M.; Cole, R.M. (Tennessee Valley Authority, Chattanooga (USA)). Mar 1977. 58p. (PRS—19). NTIS PC A04/MF A01.

The report describes the systematic test program that led to the development of washing techniques that maintain continuous mist eliminator performance for lime/limestone closed-loop scrubbing systems. TVA recently demonstrated the techniques at its 1-MW pilot plant at the Colbert Power Plant. The report also describes high-velocity scrubbing tests performed in conjunction with the mist eliminator tests. Continuous operation of the chevron mist eliminator, positioned horizontally in a vertical duct, in the limestone system was maintained (after extensive testing at 12.6 ft/sec) by washing the bottom of the mist eliminator intermittently with all the available clarified liquor, immediately followed by an allocated amount of makeup water. The top of the mist eliminator was washed intermittently with the remaining allocation of allowable makeup water. At a gas velocity of 16 ft/sec, the scrubber operated more efficiently and mist eliminator performance was improved. Continuous mist eliminator performance in the lime system was maintained at 12.5 and 16 ft/sec by washing the bottom of the mist eliminator intermittently with an allocated amount of allowable makeup water. The remainder of the allocated makeup water was used to intermittently wash the top of the mist eliminator.

**21526 Operation of an electroprecipitator influence of the main parameters.** Aureille, R.; Blanchot, P. (Electr de Fr). *Rev. Gen. Electr.;* **86**: No. 6, 515-520(Jun 1977). (In French).

Operation of an electroprecipitator is tested on a semi-industrial pilot plant, the fumes being represented by a homogeneous mixture of cold air and flyash from a thermal power plant. The effect of different parameters on the operation of the plant is studied systematically. It is noted that migration speed (and dust-precipitating efficiency) might be noticeably increased if one simply changed the shape of spray electrodes, or the distance between electrodes of opposite polarity or even the concentration distribution at the inlet, all other conditions remaining unchanged.

**21527 Nitrogen oxide formation in the fuel spray of a vortex burner burning a mixture of anthracite fines and sludge.** Babii, V.I.; Verbovetskii, E.Kh.; Zhukov, I.T. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 3, 27-31(Mar 1977). (In Russian).

The development of combustion and formation of nitrogen oxides in the fuel spray of a vortex burner of a TPP-110 boiler when burning anthracite fines mixed with anthracite sludge as well as with some addition of Kuznetsk lean coal is investigated. The maximum rate of formation of nitrogen oxides occurs at a distance of approximately 1.5 m from the burner in the moderate temperature zone (1400 to 1450 C). Its value is by three orders higher than the value of the molecular nitrogen oxidation rate calculated in accordance with the thermal theory.

### SITE SELECTION AND LAND USE

*REFER ALSO TO CITATION(S) 21520*

**21528 Electric power transport or coal transport - where to build new stone coal power plants.** Herrmann, G. *Energiewirtsch. Tagesfragen;* 27: No. 4, 287-289(Apr 1977). (In German).

The question of the best site selection for new coal power plants is discussed.

## POWER TRANSMISSION AND DISTRIBUTION

*REFER ALSO TO CITATION(S) 21470, 21471, 21742, 21748*

**21529** (EPRI-EL—482) **Modeling of arc discharges in power circuit breakers. Final report.** Cohen, I.M.; Whitman, A.M. (Pennsylvania Univ., Philadelphia (USA). Dept. of Mechanical Engineering and Applied Mechanics). Nov 1977. 143p. Dep. NTIS, PC A07/MF A01.

Power system growth places increasing performance requirements on power circuit breakers. As part of the effort to develop these breakers, a more detailed understanding of arc interruption is needed. One approach to providing this understanding is arc modeling, such as reported here. Previous mathematical studies of arcs have been largely of two types; either they have been extremely simple to allow mathematical manipulations to proceed, or they have been highly complex to attempt as accurate as possible representation of the arc. In the former case, the models are often unrealistic and just as often are not mathematically rigorous, while in the latter case they are so complicated that physical insight is lost. The study in this project falls close to the first category, although an attempt is made to be as realistic as possible and insure that the mathematical reasoning is rigorous. The question that this model attempts to answer is: "What effect does electrode geometry have on an electric arc." This problem is attacked in a quantitative way in terms of the curvature of the electrodes. The next question is whether, after a given interruption attempt, the fault will be cleared. A new type of mathematical attack on this problem was initiated with the model, and it shows that an interruption criterion can be obtained in a rigorous and physically meaningful way. The analysis is based on the stability of the mathematical model. The results show how much any interruption depends on arc characteristics and circuit parameters. Real power circuit breakers are influenced by convection and radiation, which are mechanisms for energy dissipation. In order to make the model more realistic, it has been extended to incorporate these effects. Previous experience with the simpler models has given an insight as to how to deal with these complications.

**21530** (EPRI-EL—588) **Use of two-phase heat transfer for improved transformer cooling. Final report.** Saaski, E.W.; Franklin, J.L. (Sigma Research, Inc., Richland, Wash. (USA)). Nov 1977. 216p. Dep. NTIS, PC A10/MF A01.

The potential for significantly improving transformer thermal performance by implementing new heat transfer technology was investigated. The investigation centered around two-phase heat transfer techniques and devices. Equipment was considered that was active (that is, consumed energy), as well as equipment that was passive. For power class transformers, for example, this included such devices as a forced-flow heat pipe as well as a heat pump system in which a vapor compressor reduces the transformer oil temperature below that of ambient air. Cost comparisons were made for both systems, with the former appearing cost competitive in forced air operation and the latter appearing cost competitive in the thermal dissipation range of 20 to 200 kW. Additional effort was also

directed toward studies of improved single-phase cooling systems for power transformers, including the development of a more precise technique for modeling thermosyphon flow and its application to the design of finned aluminum transformer radiators. The use of two-phase heat transfer techniques was considered in particular detail for applications where effective heat rejection is difficult using existing technology. For underground transformers, reflux condenser systems were considered as a means of increasing load capability. In particular, heat pipes linking the transformer to surrounding soil were found to be an optimal method of cooling. An additional benefit of this transformer cooling investigation was development of two possible methods of measuring core and coil temperatures. These methods and the design of the measuring equipment are discussed.

**21531** (ORNL/EIS—122) **Environmental aspects of transmission lines: a selected, annotated bibliography.** Dailey, N.S. (comp. and ed.). (Oak Ridge National Lab., Tenn. (USA)). Dec 1977. Contract W-7405-ENG-26. 195p. Dep. NTIS, PC A09/MF A01.

This bibliography contains 663 entries from the available literature (1949 to October 1977) on the impacts to wildlife and vegetation from construction and operation of transmission facilities and from clearing and maintenance of rights-of-way. The subject categories covered are ecology; monitoring, measurement, and analysis; management; biological aspects in plants; biological aspects in animals; medical aspects; legal and political aspects; and engineering. Information on the related subjects of logging, clear-cutting, and road construction is also included. Indexes are provided for author, keywords, subject category, geographic description, taxon, and permuted title.

**21532 Electrical power generation and distribution system.** Jeppson, M.R. US Patent 4,057,736. 8 Nov 1977. Filed date 13 Sep 1974. 36p.

Problems associated with moving fuel from remote sources to large centralized power generation plants are avoided with an economical system for collecting power from small stations located near the scattered, remote fuel sites. To avoid a need for many massive, costly transformers, a plurality of relatively low voltage generating stations are connected in series to cumulatively produce the high voltage needed for long-distance transmission line delivery. Power-generating devices of the successive stations are supported on insulative structures of progressively greater height and are driven or supplied with fuel through insulative means. The generating devices may take various forms including, for example, ac or dc generators driven through insulative drive shafts or fuel cells or magnetohydrodynamic devices supplied with fuel through insulative pipes and the system is adaptable to large-scale power production from scattered energy sources such as oil or natural gas wells, oil shale mines, geothermal steam wells, coal mines, solar energy sources or hydro-electric installations, for example. The stations may be adjacent, widely separated or vertically spaced apart within a single structure depending on the nature of the fuel source. Power may be converted to smaller voltages at the distribution region by coupling a plurality of electrical motors in series, each being supported on insulative structure, and each driving a generator through an insulative shaft.

**21533 Welded pipe line system, insulated by sulfur hexafluoride, made of an aluminium alloy, for power transmission.** Dick, G. (Vereinigte Aluminium-Werke A.G., Bonn (Germany, F.R.)). *Schweissen Schneiden;* **29**: No. 9, 368-371(Sep 1977). (In German).

Encased, $HF_6$-insulated cables are used for underground power transmission from the 1,000 MW underground hydro-electric power plant at Wehr. This is a report on their fabrication and installation, in particular the welding and test methods employed. Materials selection and alternative production methods for the jacket tubes are discussed.

**21534 Energy and information transmission in 20 kV medium-voltage systems using the phase-wire cable system.** Benndorf, H.; Stichling, F. (Badenwerk A.G., Karlsruhe (Germany, F.R.)); Kirch, H.J.; Levacher, F.K. (Felten und Guilleaume Carlswerk A.G., Koeln (Germany, F.R.)). *Elektrizitaetswirtschaft;* **76**: No. 19, 643-653(Sep 1977). (In German).

'Phase-wire cable' is the term for a novel system for energy and information transmission over high-voltage overhead lines. This system is a combination of an overhead-phase wire and an overhead telecommunications cable. The first installation of this type which was developed by Badenwerk AG, Karlsruhe, and Felten and Guilleaume Carlswerk AG, Cologne, in collaboration, was taken into operation at the end of 1974 in the 110 kV system of Badenwerk AG. The satisfactory operational experience gave the incentive to match the systems by cooperative work to the requirements also of 20 kV systems. The authors report on the guidelines of the technical development and describe the constructional arrangement on the basis of the first section installed on a 20 kV overhead line, discuss the results of measurement achieved, and make comparisons with a self-supporting overhead telecommunications cable.

**21535 Simulation of the active power dynamics of parallel-circuit electrical energy supply networks.** Mathias, G. (Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A.G., Nuernberg (Germany, F.R.). Forschungsabteilung Dampf). *VGB Kraftwerkstech.;* **57**: No. 7, 467-473(Jul 1977). (In German).

The model of an interconnected (multi-unit) electrical energy supply system developed in this contribution makes clear that the alternating active power in production-side (from the generator or from the turbine) and consumption-side disturbances are either of a motor-like nature or an ohmic nature. The determination layed out here of the network frequency as a quantity to be considered in every transient phenomenon of the examination allows us an unequivocal physical description of the coupling of the system parts in the multi-unit network. Schematic diagrams have been worked out which can serve for an analogous or also a digital simulation of the system dynamics. The resulting balance power for the individual partial networks serve to determine the power delivered to the coupling points, where, from case to case, depending on the network structure, a network calculation including the power resistances would have to be carried out; using the available handling, this would be a pure algebraic follow-up calculation. The complete distribution of the power transmission is determined according to the minimum principle after the sum of all lost power in the interconnected network has reached its possible minimum.

**21536 Fast-tripping operation of the coupling bay protection in case of faults in the immediate vicinity of the busbars.** Chenzbraun, I. (Dispecerul Energ Natl, Bucharest, Rom). *Oesterr. Z. Elektrizitaetswirtsch.;* **30**: No. 7, 331-336(Jul 1977). (In German).

Coupled double-busbar operation offers substantial advantages over single-busbar operation for the operation of the system, provided an adequate coupling bay protection design is ensured. In case of a nearby fault, fast tripping of the coupling bay circuit breaker separates the sound part of the system from the faulty one, improves the back-up protection performance in the case of both circuit-breaker and relay faults, and can also be used for reducing the short-circuit stress of switchgear. This report demonstrates the conditions under which fast tripping of the coupling bay protection is considered permissible on the Roumanian high-tension system. The parameters as well as a computer program for the admissibility of fast tripping of the coupling circuit breaker are given.

**21537 Rational utilization of medium-capacity power blocks when passing through deep lows of electric load graphs.** Dorokhov, E.V.; Klushin, Yu.A.; Arakelyan, E.K. (Moscow Energet Inst, USSR). *Teploenergetika (Moscow);* No. 2, 78-80(Feb 1977). (In Russian).

A method of selection of a combination of operating conditions of power units when passing through nocturnal lows of electric loads upon power plants is considered. A table presents statistical evaluations of loads of four power plants during the morning peak period, and a diagram shows the distribution of relative frequencies of different load conditions of blocks of a power plant during a night in January. The method proposed is based on the variant method. It permits determination of the most efficient combinations of operating conditions to utilize power units depending on the depth and duration of the graph low, and on the rapidity of reading the maximum load. 9 refs.

**21538 Transient stability criteria.** Fouad, A.A. (Iowa State Univ., Ames). pp 309-314 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

A survey of the criteria of stability used in the power system transient stability problem was made. The status of progress in the use of these methods is given, and the areas of difficulty are outlined.

**21539 Stability of interconnected systems.** Athans, M. (Massachusetts Inst. of Tech., Cambridge); Sandell, N.; Varaiya, P. pp 456-462 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

An elementary survey of recent work analyzing the stability of interconnected systems is presented. The points of view used to organize the survey are computational complexity, methods of analysis, the implication of the analysis for model simplification, and applicability to power systems. A fairly comprehensive bibliography is appended. Some suggestions for research are given.

**21540 Application of the statistical theory of feedback to power system identification.** Caines, P.E.; Sinha, S. (Univ. of Toronto). pp 584-589 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Two processes are termed strongly (respectively weakly) feedback free when the canonical innovations representation (IR) of the joint process has one of two specified structures respectively. The property that two processes are feedback free captures the notion of a unique direction of influence between two processes. A set of equivalent characterizations of this property is presented. These characterizations yield a set of statistical tests for feedback. When feedback exists between two processes it is possible to identify the separate loops of the IR by prediction error methods. However, it is only when the disturbances in each loop are mutually orthogonal, and one of the loops contains a delay, that the loops so identified constitute the feedforward and feedback loops of the observed physical system. How closed loop identification problems arise in load and generating source identification in power systems are discussed. Some initial simulation results obtained by applying a spectral factorization algorithm to the problem of closed loop system identification are presented. Further, the application of this algorithm to real power system data is described.

**21541 Application of microcomputers to the protection and control of power system substations.** Russell, B.D. (Univ. of Oklahoma, Norman). pp 590-591 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

The use of digital computers for power system protection and control has been studied for the past decade. However, economic considerations, reliability problems, and system constraints have prohibited the actual use of computers in substation protection schemes. Recent advances in microcomputer technology have provided power system protection engineers with a new tool. A distributed microcomputer protection scheme is introduced and compared to present substation protection techniques. Speed, reliability, and operating advantages as well as the adaptive control possibilities of the proposed system are pursued.

**21542 Power lines and the environment.** Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973). 176p. (CONF-730650—P1). .

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

Ten papers were presented at the meeting. A separate abstract was prepared for each paper. (LCL)

**21543 Ecological perspectives of power transmission.** Goodland, R. (Cary Arboretum of the New York Botanical Garden, Millbrook, NY). pp 1-35 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

As of 1969 the U.S. had over 100,000 miles of power transmission lines pre-empting 4 million acres of ground. By 1990 7 million acres will be needed for transmission line rights of way. The environmental aspects of siting, clearing, constructing, and maintaining transmission lines and their associated equipment, the evaluation of need for transmission facilities, planning and use of land in rights of way, environmental considerations of ozone generation by electrical discharges from power lines, and the environmental impact of underground, microwave, and other advanced transmission systems are discussed. (LCL)

**21544 Microclimate modification due to power transmission rights of way.** Herrington, L.P. (State Univ. of New York, Syracuse); Heisler, G.M. pp 36-57 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

Microclimate is the climate, i.e., temperature, humidity, precipitation, solar and infrared radiation, and wind, near the ground. The physical basis for microclimate control is presented, and the impacts which power transmission line rights-of-way have on the microclimate of the right-of-way itself are discussed. It is concluded that in developing rights-of-way (R/W), the removal of tall vegetation such as trees or high brush will result in changes in the microclimate and hence changes in the vegetation on the surface and in water budgets and stream temperatures. The changes in microclimate will be due to changes in the location of the active surface and to changes in albedo of the absorbing surfaces. One of the most important potential adverse impacts that the construction of power transmission R/W may have is on stream temperatures. The impacts of power transmission R/W on general climate and indirectly on watershed hydrology are minimal. However, changes in microclimate may cause changes in flora and fauna which may or may not be desirable. There is also the possibility of designing R/W so that specific microclimate effects may be achieved to help in the ecological management of the R/W or to provide specific conditions for various human activities if some form of multiple land use is intended.

**21545 Selective planting for the encouragement of wildlife.** Zuck, R.K. (Drew Univ., Madison, NJ). pp 72-77 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

It is known that recently cut-over forests, with the subsequent growth of herbaceous plants, bushes, and young trees support much more animal life than the original forest. Cleared rights-of-way for pipelines and power transmission lines provide ideal conditions for plantings which will encourage wildlife. The kind of plants and planting methods used in a New Jersey experiment to promote wildlife populations in the area under a power line are discussed. (LCL)

**21546 Multiple use potential along power transmission rights of way.** Randall, W.E. (Univ. of Massachusetts, Amherst). pp 89-113 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

The desirability of using power transmission line rights-of-way as transportation corridors, or industrial, agricultural, or recreational areas is discussed in terms of safety, public acceptance, aesthetics, regulations, and economics. (LCL)

**21547 Historical and legal aspects of transmission lines.** Irwin, H.S. (New York Botanical Garden, Bronx). pp 114-132 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

The environmental effects of power transmission lines, the amount of land required for transmission line rights-of-way, state and federal regulations on right-of-way acquisition, and the effects of the National Environmental Policy Act on power transmission planning are discussed. (LCL)

**21548 Preparing environmental impact statements: comments based on personal experience.** Stalter, R. (St. John's Univ., Jamaica, NY). pp 133-149 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

To aid in the preparation of environmental impact statements for power line rights-of-way the National Environmental Policy Act of 1969 provides guidelines for description of the proposed action, for description of the project, financing of the project, and for the use of adjacent land and the proposed facilities. After an evaluation of the aforementioned, the study must also include an environmental impact statement of the proposed action. This model statement shall contain information pertaining to impact on soils, flora, fauna, water resources, and aesthetics and impact on wilderness areas, historical areas, aviation corridors, and economics of the study area. The model statement shall include both favorable environmental effects and the unavoidable adverse environmental effects of a project. Alternatives to a proposed action are also considered such as no transmission line, alternate transmission line routes, alternate types of construction, and alternate methods of construction. The above will deal with the relation between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. Methods dealing with vegetation analysis, soils, water resources, and impact on aesthetics will be discussed.

## AC SYSTEMS, EHV AND UHV

**21549 (EPRI-EL—220) Study of gas dielectrics for cable insulation. Final report.** (Massachusetts Inst. of Tech., Cambridge (USA). High Voltage Research Lab.). Oct 1977. Contract EX-76-C-01-2556. 159p. Dep. NTIS, PC A08/MF A01.

As a result of this project, it is concluded that $SF_6$ gas can, given proper attention to equipment design details, serve as a dielectric for the highest voltages contemplated by the electric utility industry. An integral part of the program was the successful design, construction, and operation of the highest voltage gas dielectric cable test facilities for studies at UHV levels. The results of the research at these levels demonstrated that $SF_6$ as a dielectric can be used to insulate the required withstand voltages for UHV apparatus.

This work indicates that there is no total voltage effect that could impose a limit to the design levels attainable with this gas. The $SF_6$ behaved well in the sense that its dielectric strength was predictable over a broad range of conditions. In addition, $SF_6$ was found to maintain a substantial dielectric superiority over air or nitrogen in the larger systems studied. Some alternative gases and mixtures were also assessed, though not to the same extent as $SF_6$.

**21550** (HCP/T6010—E1) **ac transmission line field measurements.** Kotter, F.R.; Misakian, M. (National Bureau of Standards, Washington, D.C. (USA). Inst. for Basic Standards). Nov 1977. Contract EA-77-A-01-6010. 79p. Dep. NTIS, PC A04/MF A01.

The concern in recent years over the environmental effects of electric and magnetic fields from high voltage transmission lines has also focused attention on the accuracy of measurements of these fields. Electric field meters are discussed in terms of theory of operation, parameters affecting performance, meter performance under field and laboratory conditions, and calibration procedures. The performance and calibration of magnetic field meters is described. (LCL)

**21551** **New 380 kV lines constructed by the Bayernwerk AG.** Kiessling, F. (Siemens A.G., Erlangen (Germany, F.R.). Abt. ESTE); Meier, P. (Bayernwerk A.G., Muenchen (Germany, F.R.)). *Elektrizitaetswirtschaft;* **76**: No. 19, 637-642(Sep 1977). (In German).

The Bayernwerk AG has since 1970 built a 380 kV system. The authors give a report on the development of the support rods required for the purpose, when the requirement by the authorities for running several circuits, even at different voltages, on one rod, had to be taken into account. Further details are given on the selection of the cables, of the insulators and fittings, on the design, the calculation and the construction of the towers, and on the types of earthing adopted during the erection of the line.

**21552** **Environmental management during power transmission line construction: operational considerations.** Dohrenwend, R.E. (Cary Arboretum of the New York Botanical Garden, Millbrook, NY). pp 58-71 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

The activities which the forester, environmental manager, or ecologist should engage in during the planning and construction of power transmission lines in order to minimize environmental or ecological damage is described based on experience with the construction of a 345 kV overhead power transmission line in New York State. (LCL)

### SUPERCONDUCTING AND CRYOGENIC SYSTEMS

*REFER ALSO TO CITATION(S) 22007*

**21553** (LA—7037-PR) **LASL $Nb_3Ge$ conductor development. Eighth quarterly progress report, July 1—September 30, 1977.** Maley, M.P. (comp.). (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1977. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

The progress of the Los Alamos Scientific Laboratory program to develop $Nb_3Ge$ as a superconductor with potential applications to superconducting power transmission lines is reported. Forty-two Cu and Ni tapes each 0.64 cm wide and one meter in length were coated with 4 to 6 μm thicknesses of $Nb_3Ge$ by chemical vapor deposition. The tapes were analyzed by x-ray diffraction, revealing a compositional variation in the percentage of $Nb_3Ge_2$ along the length. The source of this problem was identified and virtually eliminated by altering the start-up procedure for the CVD reactor. Tapes are now being produced which are essentially uniform over a 1.0 m length and which have critical current densities of $2.0 \times 10^6$ A/cm² at 13.8 K. Measurements of critical current in magnetic fields up to 10.0 T and pinning force determinations are also reported. Finally, successful measurements of the ac loss in tape samples were performed with 500 rms A/cm losses being as low as approximately 11 μW/cm² at 4 K.

## NUCLEAR POWER PLANTS

*REFER ALSO TO CITATION(S) 21703, 21745*

**21554** **Transactions of the American Nuclear Society 1977 winter meeting held Nov. 27—Dec 2, 1977, in San Francisco, California.** Farmakes, R. (ed.). *Trans. Am. Nucl. Soc.;* **27**: 1-1028(1977). (CONF-771109—).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

Each summary has been separately processed for the Energy Data Base. (DG)

**21555** **Implementation of availability engineering in the nuclear utility industry.** Long, R.L. (Univ. of New Mexico, Albuquerque); Cleveland, E.B. *Trans. Am. Nucl. Soc.;* **27**: 96-97(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, BOILING WATER COOLED

*REFER ALSO TO CITATION(S) 21623, 21637, 21642, 21648, 21649, 21650*

**21556** (EPRI-NP—567) **Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report.** Sherby, O.D. (Stanford Univ., Calif. (USA). Dept. of Materials Science and Engineering). Dec 1977. 118p. Dep. NTIS, PC A06/MF A01.

A set of constitutive equations has been developed which provides a broad, general purpose, phenomenological model for the non-elastic deformation of Zircaloy. The equations cover in-reactor, out-of-reactor, and post-irradiation behavior, and simulate a very wide variety of deformation phenomena including "short-time" plasticity, "long-time" creep, cyclic stress-strain behavior, recovery, dynamic strain aging effects, irradiation effects, behavior under complex stress and temperature histories, and interactions of these phenomena.

**21557** (NEDO—20913A) **Lattice physics methods. Licensing topical report.** Martin, C.L. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Feb 1977. 80p. Electric Co., San Jose, CA.

Portions of document are illegible.

The lattice physics methods in use at the General Electric Company for the nuclear design of initial and reload fuel bundles are presented herein. The sources of nuclear data are listed and all of the basic calulations are described. The presentation emphasizes three basic areas: the determination of few group cross sections based on neutron spectrum calculations; the calculation of the flux and rod power distributions; and the evaluation of the effects of fuel exposure.

**21558** **Chemistry of feedwater for boiling-water and pressurized-water reactors.** Bodmer, M.; Svoboda, R. *Combustion;* **49**: No. 2, 12-19(Aug 1977).

This article defines the characteristic parameters of a condensate polishing plant (CPP), such as the "degree of polishing" and "practical exchange capacity of the resins" and indicates how they can be determined. In pressurized-water reactors (PWR) the feedwater is normally conditioned with hydrazine. Measurements are quoted to demonstrate that, in contrast to conventional plants, the point of injection is immaterial as regards the copper content of the feedwater. Moreover, the iron content of the feedwater of a PWR can be reduced by using cyclic amines. The feedwater chemistry of a boiling water reactor (BWR) is discussed by referring to oxygen, iron and copper measurements. 10 refs.

**21559** **Assessment of two-phase pressure drop correlations for steam-water systems.** Idsinga, W.; Todreas, N.; Bowring, R. (MIT, Cambridge, Mass). *Int. J. Multiphase Flow;* **3**: No. 5, 401-413(Aug 1977).

A number of two-phase friction pressure drop correlations in the literature have been examined for their applicability to Boiling Water Reactor conditions. They were tested against about 2220 experimental steam-water pressure drop measurements under adiabatic conditions and about 1230 in diabatic flow conditions. The four models and correlations which were found to have the best performance were the Baroczy correlation, the Thom correlation and the homogeneous model two-phase friction multipliers. 31 refs.

**21560** **Concerning a relation in piston compressor thermodynamics.** Kopelevich, A.S. (Khabarovsk Polytech Inst, USSR). *Teploenergetika (Moscow);* No. 4, 47-50(Apr 1977). (In Russian).

Analytical derivation and results of experimental verification of a functional dependence relating the temperature of the forced gas to some independent parameters of the stage are presented.

**21561** **Some problems of optimization of thermal diagrams of single-loop nuclear power plants.** Margulova, T.Kh.; Zorin, V.M.; Al'tshuller, M.A. *Teploenergetika (Moscow);* No. 2, 76-78(Feb 1977). (In Russian).

Problems related to the selection of the structure of the regenerative feedwater heating, structural materials, and sizes of heat exchange surfaces are considered. The first Soviet single-loop plants envisaged cascade drainage of condensates of the steam heating regenerative heaters, in order to minimize the quantity of corrosion products in feedwater; this however reduced thermal efficiency. Alternatives to improve efficiency and reduce corrosion are considered.

## POWER REACTORS, NON-BREEDING, LIGHT-WATER MODERATED, NON-BOILING WATER COOLED

*REFER ALSO TO CITATION(S) 21556, 21558, 21619, 21623, 21624, 21634, 21637, 21638, 21639, 21645, 21646, 21647, 21648, 21652, 21655, 21662, 21902*

**21562** (LTR—1310-17) **Impedance calculations for power cables to primary coolant pump motors.** Hegerhorst, K.B. (EG and G Idaho, Inc., Idaho Falls (USA)). 27 Oct 1977. Contract EY-76-C-07-1570. 15p. Dep. NTIS, PC A02/MF A01.

The LOFT primary system motor generator sets are located in Room B-239 and are connected to the primary coolant pumps by means of a power cable. The calculated average impedance of this cable is 0.005323 ohms per unit resistance and 0.006025 ohms per unit reactance based on 369.6 kVA and 480 volts. The report was written to show the development of power cable parameters that are to be used in the SICLOPS (Simulation of LOFT Reactor Coolant Loop Pumping System) digital computer program as written in LTR 1142-16 and also used in the pump coastdowns for the FSAR Analysis.

**21563** (TREE-NUREG—1177) **Postirradiation examination results for the Irradiation Effects Test Series IE-ST-2, Rod IE-002.** Murdock, B.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1977. 42p. Dep. NTIS, PC A03/MF A01.

A postirradiation examination was conducted on a zircaloy-clad, $UO_2$-fueled, pressurized water reactor (PWR) type rod which had been tested in the Power Burst Facility as part of the Irradiation Effects Test Series of the Thermal Fuels Behavior Program. The fuel rod, previously irradiated to a burnup of 15,800 MWd/t was subjected to a power ramp from 28 to 55 kW/m peak power at an average ramp rate of 4 kW/m/min. Posttest fuel restructuring and relocation, fission product redistribution, and fuel rod cladding deformation were evaluated and analyzed.

**21564** **Metallurgical evolution of heavy forgings in low alloys steels for nuclear vessels.** Cadiou, L.; Comon, J.; Dunand-Roux, L.; Vassal, J.; Houssin, B. (Creusot-Loire, Fr). *Mater. Tech.;* **65**: No. 6, 341-357(Jun 1977). (In French).

This paper describes the materials currently used for reactor vessels and points out a few of the major trends of metallurgical research on heavy forgings made of a high-strength nickel-chromium-molybdenum grade steel, SA 508 C 13. In addition, the results of a research program seeking to develop alloys with improved mechanical properties by appropriate heat treatment and increases in the nickel content are presented.

**21565** **Stainless steel thick plates for light-water reactors.** Rabbe, P.; Ferriol, J.; Catelin, D. (Creusot-Loire, Fr). *Mater. Tech.;* **65**: No. 6, 359-366(Jun 1977). (In French).

The purpose of this paper is to specify the various technical requirements which have led to selecting certain grades of stainless steel other than those commonly used in American pressurized water reactors (AISI 304 H and 316 H) for PWR nuclear power stations constructed in France and to describe the major features of the corresponding plates. The new alloys developed have the same mechanical strength as AISI 304 H and 316 H but have higher intergranular corrosion resistance.

**21566** **Production and testing of tubes for nuclear boiler steam generators.** Jacson, M. (Soc Vallourec, Fr). *Mater. Tech.;* **65**: No. 6, 367-372(Jun 1977). (In French).

A description is given of the procedures and equipment used in the production and testing of very long steam generator tubes in the various operations of cold rolling, heat treatment, polishing, nondestructive testing, bending, annealing, and chemical passivation.

**21567** **Cast channel heads in low alloy steel for PWR steam generators.** Roux, F.; Thomas, A.; Nectoux, G.; Delorme, A. (Creusot-Loire, Fr). *Mater. Tech.;* **65**: No. 6, 387-402(Jun 1977). (In French).

A description is given of the production and testing of a large cast nuclear reactor component made of low alloy steel and weighing about 30 tons. In order to ensure good rupture strength and good deformability and also to ensure good weldability, the smelting of the steel was carried out in a basic-lined electric furnace according to the so-called "two slag" technique with a refining period and a killing period. During the casting the 100 tonnes of molten metal required are poured using two ladles to obtain a regular casting speed, in excess of 20 tons per minute. The down gates and in-gates are designed and arranged to avoid any turbulent flow which might damage the walls of the mold and give rise to exogenous inclusions. 5 refs.

**21568** **Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters.** Seraphin, L.; Mathern, G.; Crolet, J.L.; Tricot, R. (Ugine Aciers, Fr). *Mater. Tech.;* **65**: No. 6, 403-414(Jun 1977). (In French).

Problems relating to the use of special steels in certain components of nuclear reactors are reviewed, including irradiation embrittlement and temper brittleness of low-alloy steel reactor vessels, corrosion of stainless steel components of the primary and secondary cooling circuits, and problems relating to welding. 32 refs.

**21569** **Investigation of optimal control strategies to an integral economizer U-tube steam generator.** Robertson, F.R.; Reddoch, T.W.; Kerlin, T.W. (TVA, Chattanooga, Tenn). pp 609-612 of In Proceedings of the Institute of Electrical and Electronics Engineers conference. New York; Institute of Electrical and Electronics Engineers (1977).

From Institute of Electrical and Electronics Engineers conference; Williamsburg, VA, USA (4 Apr 1977).

The application of optimal control theory to the controller design of an integral economize U-tube steam generator is presented. Problem formulation and control strategies are developed. Comparison to conventional control strategies are made. 8 refs.

**21570** **Sundesert reliability engineering.** Bernath, L.; Latham, D.W. (San Diego Gas and Electric Co., CA). *Trans. Am. Nucl. Soc.;* **27**: 97(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## POWER REACTORS, NON-BREEDING, GRAPHITE MODERATED

*REFER ALSO TO CITATION(S) 21659*

**21571** (GA-A—13557) **Evaluation of BISO and TRISO coated $ThO_2$ fuel particles irradiated in HFIR capsules HT-12 through HT-15 and HT-17 through HT-19.** Scott, C.B. (General Atomic Co., San Diego, Calif. (USA)). Oct 1977. Contract EY-76-C-03-0167-017. 75p. Dep. NTIS, PC A04/MF A01.

The HT-12 through HT-15 and HT-17 through HT-19 capsules were uninstrumented experiments conducted in the target position of the High Flux Isotope Reactor at Oak Ridge National Laboratory. The experiments were utilized as evaluation tests of fertile particle coating designs and PyC properties and they provide a basis for normalization of fuel particle design and performance models. A total of thirteen different BISO $ThO_2$ particle designs were irradiated to fast neutron fluences ranging from 1.8 to 14.6 x $10^{25}$ n/m$^2$ ($E > 29$ fJ)/sub HTGR/ and heavy metal burnups ranging from 1.0 to 15.8% FIMA at temperatures of 1025° to 1580°C. The results indicated that BISO $ThO_2$ particles can be fabricated to survive the most severe large HTGR design irradiation conditions and that anisotropy of the OPyC coating, which is a strong function of coating rate, is one of the most important variables affecting the irradiation performance of BISO coated fertile particles.

**21572** (GA-A—13723) **Behavior of fission product gases in HTGR fuel material.** Myers, B.F.; Baldwin, N.L.; Bell, W.E.; Burnette, R.D. (General Atomic Co., San Diego, Calif. (USA)). Oct 1977. Contract EY-76-C-03-0167-017. 122p. Dep. NTIS, PC A06/MF A01.

This document is a status report on experimental data relating to the behavior of fission product gases in HTGR fuel material. It contains (1) a review of published experimental data on the behavior of gaseous fission products (noble gases, halogens, and related elements) in HTGR fuel materials and (2) new data on fission gas behavior. From the experimental data, the effects of fission product element, fuel configuration, nuclide half-life, temperature, pressure, neutron flux, neutron fluence, and fuel hydrolysis on fission gas release are deduced. Also on the basis of the experimental data, a model is formulated for the release of fission gases from fuel rods. The data presented in this report are being confirmed and extended through continuing work at General Atomic and other laboratories.

**21573** (GA-A—14684) **Low-enrichment and mid-enrichment denatured (thorium) fuels for the HTGR: a feasibility study. Final report.**

(General Atomic Co., San Diego, Calif. (USA)). Oct 1977. Contract EY-76-C-03-0167. 382p. Dep. NTIS, PC A17/MF A01.

Operation of HTGRs on proliferation-resistant, low-enrichment and denatured (thorium) fuel cycles is both feasible and practical, based on the findings of a Feasibility Study conducted for the Department of Energy by General Atomic Company. These alternate fuels can be effectively utilized in the first generation of commercial HTGRs, although additional on-going studies are required to optimize the fuel cycle and to verify the fuel design. The Fort St. Vrain HTGR is suitable for an early demonstration of these fuels. This report describes the analyses performed to evaluate the feasibility and optimization of such fuels, their impact on core and plant design, processes for their fabrication, and options for their recycle and waste management. A strategy and schedule for testing of these proliferation-resistant fuels in the Fort St. Vrain HTGR are also included.

**21574 Fundamentals on the agglomerate model and its relation to the physical properties of pyrocarbon.** Linke, J.; Koizlik, K.; Nickel, H. (Kernforschung Jeulich, Inst fuer Reakt, Ger). *Nucl. Technol.;* **35**: No. 2, 257-262(Sep 1977).

For a long time, the deposition mechanism of pyrocarbon (PyC) from the gas phase has been interpreted in terms of diverse models. Today, the so-called droplet or agglomerate model shows a high degree of reliability. It quantitatively describes the growth mechanism of agglomerates, initiated by chemical and physical processes, taking place in the gas phase. From this model, one can deduce the morphology of the originating agglomerates, i.e., their final size as well as their composition of different components, and can correlate these results to the physical properties of the resulting PyC material.

**21575 Design, erection, maintenance and operation of helium compressors for the Thorium High Temperature Reactor at Schmehausen.** Tomica, H. (Ver Elektrizitaetswerke Westfal, Dortmund, Ger). *VGB Kraftwerkstech.;* **57**: No. 8, 526-530(Aug 1977). (In German).

The paper describes the requirements regarding the reactor cycle, the reactor coolant and reactor safety and indicates typical design features arising therefrom for the compressor and its auxiliary systems. The procedures developed for removal and reinstallation of the compressor for maintenance or repairs are outlined. The characteristic modes of operation--starting up from the cold state, full and partial load operation, and normal shutdown--are explained. 5 refs.

**21576 Reactions between SiC and Pd or $CeO_2$ at high temperatures.** Suzuki, H.; Iseki, T.; Imanaka, T. (Tokyo Inst of Technol, Meguro-ku, Jpn). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 438-442(Jun 1977).

The reaction between SiC and Pd began at about 1,000°C, and the products were $Pd_2Si$ and $Pd_9Si$. A mixture of SiC and $CeO_2$ produced no detectable amount of product when heated in air up to 1,500°C, but when heated in vacuum, reaction began above 1,100°C, which generated different products depending on the conditions. Two unknown phases appeared during the heating. These phases were $Ce_4(SiO_4)_3$ and cubic $CeC_2$. 15 refs.

**21577 Displacement measurements at high temperatures with capacitive transducers.** Turner, H.J.; Nye, A.E.T. (Cent Electr Res Lab, Surrey, Leatherhead, Engl). pp 117-134 of In Conference on the operation of instruments in adverse environments. London; Institute of Physics (1977).

From Conference on the operation of instruments in adverse environments; London, UK (4 Oct 1976).

See CONF-7610120—.

Capacitive displacement gauges can be easily designed and constructed in a variety of geometries to suit particular measurements needed. Because the capacitance depends only on the geometry, which can be very simple, the gauges may be made of a material to suit the environment. Measurements are made on a generating plant including rotary-hood air heaters and a nuclear boiler. Although the air heaters are not an ideal environment due to the presence of dust and water vapor, capacitive transducers are successfully used. In one experiment, coplanar-electrode transducers are mounted on the rotary hood in the hot air stream, necessitating the use of specially screened slip rings. In another, they are mounted on the stator and subject to alternate flows of hot flue gas and cool air. Further measurements are planned in a heater for use with an oil-fired boiler where the temperatures reach 390°C and sulphuric acid vapour is present. The nuclear boiler has a more suitable atmosphere, namely $CO_2$ at 280°C and 2500 kN $m^{-2}$, but long mineral-insulated cables are needed to bring the signals out of the pressure vessel. Coplanar transducers similar to those for the air heaters are used for one measurement, but parallel plates with a moving inter-electrode screen are used at a position where more range is required. Another application is on an oxidation test rig designed to monitor the rate of oxidation of stainless steels in different atmospheres. The capacitance variation between the inner wall and an insulated concentric electrode is measured. The temperature range required is 600°C to 1000°C and ionization of the gas gives problems from the high shunt conductance. Methods of overcoming these have been successful up to 800°C. 4 refs.

## POWER REACTORS, NON-BREEDING, OTHERWISE MODERATED OR UNMODERATED

*REFER ALSO TO CITATION(S) 21596, 21702*

## POWER REACTORS, BREEDING

*REFER ALSO TO CITATION(S) 21635, 21636, 21643, 21644, 21658, 21704*

**21578** (CONF-760735—1) **Leak detection system design and operating considerations for the US-CRBRP.** Kruger, G.B.; Eng, K.Y.; Kelly, W.L. (General Electric Co., Sunnyvale, Calif. (USA); Energy Research and Development Administration, Washington, D.C. (USA)). 1976. Contract EY-76-C-15-2395. 23p. Dep. NTIS, PC A02/MF A01.

From US/USSR steam generator seminar; Dimitrovgrad, USSR (26 Jul 1976).

Diffusion membrane type hydrogen detectors are provided for monitoring the sodium exiting each evaporator and superheater in the Clinch River Breeder Reactor Plant. These detectors allow detection of small water to sodium leaks and provide the plant operator with an early warning signal. Hydrogen detectors are located at the exit sodium streams of each steam generator module, the vent from the module semi-stagnant region, the cold leg piping, and in an intermediate system sodium expansion tank cover gas region. In addition, an electrochemical oxygen detector is located in the cold leg piping. The leak detection system is capable of detecting the presence of steam/water leaks on the order of $0.45 \times 10^{-8}$ kg/sec or larger and of signaling within one to three minutes upon initiation of a leak, during normal operation. Operator action is taken upon receipt of a leak signal to shutdown the affected system, by closing steam/water isolation valves and depressurizing the affected unit.

**21579** (CONF-771023—23) **Signal analysis method using cross-correlation of turbulence flow signals to determine calibration of permanent magnet sodium flowmeters.** Raptis, A.C.; Forster, G.A. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 6p. Dep. NTIS, PC A02/MF A01.

From Nuclear science symposium; San Francisco, CA, USA (19 Oct 1977).

Permanent magnet flowmeters are used to measure flow in sodium cooled power plants both in the core and in plant piping. In this paper the cross-correlation technique and in particular the transfer function method is used to process the flow turbulence signals from electrodes spaced along the pipe in the vicinity of the magnetic field. Results from a loop flowmeter the EBR-II secondary flowmeter and a 400 mm diameter flowmeter are presented.

**21580** (COO—2250-30) **MIT LMFBR blanket research project. Quarterly progress report, July 1, 1977—September 30, 1977.** Driscoll, M.J. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 1977. Contract EY-76-S-02-2250. 16p. Dep. NTIS, PC A02/MF A01.

Irradiation experiments on Mockup 5B have been completed. A series of comparative calculations are underway on internal blanket variations. Preliminary results are presented. A fnal workup of the T/sub i/(n,p) $Sc^{48}$ and N/sub i/(n,p) $Co^{58}$ threshold traverses in Blanket Mockup 5B has been completed.

**21581** (CRBRP-ARD—0147) **Clinch River Breeder Reactor Plant. Internal/external cladding degradation.** Travis, M.L. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1977. Contract EY-76-C-15-1200;EY-76-C-15-2395. 63p. .

Cladding degradation of CRBRP fuel cans due to sodium-cladding interactions, fuel-cladding interactions, and fretting wear is discussed.

**21582** (CRBRP-ARD—0188) **Clinch River Breeder Reactor Plant. Effects of thermal aging on CRBRP primary piping.** Leasure, R.A. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1977. Contract EY-76-C-15-1200;EY-76-C-15-2395. 60p. .

The primary piping systems of Liquid Metal Fast Breeder Reactors (LMFBR's) are designed for many years of safe and maintenance free, high temperature operation. The materials being used to construct these systems are primarily the austenitic stainless steels which are selected for their good high temperature mechanical properties and compatibility with the liquid sodium environment. For the Clinch River Breeder Reactor Plant (CRBRP), which is a demonstration plant in the LMFBR program with a thirty year design life, the proposed primary piping materials include Type 304

and Type 316 stainless steels. As in any system that has to operate safely and without maintenance for many years, it is necessary to examine the effects of long term service on the properties of the materials in the CRBRP piping. This report examines the effects of the major factor contributing to changes in material properties of the primary piping over the thirty year service life, i.e., thermal aging. Included in this examination are the effects of thermal aging on microstructure, tensile properties, creep, fatigue and the fracture toughness of both base metal and weldments.

**21583** (GA-A—14121) **Static test of the gas-cooled fast breeder reactor core support grid plate: comparison of experimental, analytical, and finite-element models.** Chuang, A.S.; Chang, K.H.; Washington, C.E. (General Atomic Co., San Diego, Calif. (USA)). Oct 1977. Contract EY-76-C-03-0167-023. 77p. Dep. NTIS, PC A05/MF A01.

The primary function of the gas-cooled fast breeder reactor (GCFR) grid plate is to hold core assemblies firmly in position so that the reactivity insertion associated with the plate deflection is limited to a value which satisfies plant safety requirements. Consequently, grid plate deflection under pressure is of particular importance rather than stress, as in the case of most perforated plates. Analyses were carried out using the concept of an equivalent solid material, and the equivalent solid plate was treated as a transversely isotropic elastic body. The general solutions for the axial and radial displacements were derived for a simply supported plate subject to a uniform load. The solid rim effect was also included. Experimental and finite-element models were used to confirm the theoretical results, and it was found that the three solutions are in good agreement, and the maximum axial displacement discrepancy between them is about 6%. The close agreement of the three models not only proves that the analytical derivation and finite-element model are correct, but also indicates that the equivalent Young's modulus $E^*$ and equivalent Poisson's ratio $V^*$ are accurate.

**21584** (GA-A—14613) **Gas-Cooled Fast Breeder Reactor. Quarterly progress report, August 1, 1977—October 31, 1977.** (General Atomic Co., San Diego, Calif. (USA)). Nov 1977. Contract EY-76-C-03-0167-023. 258p. Dep. NTIS, PC A12/MF A01.

Progress is summarized on the development of GCFR fuel, blanket, and control assemblies; development of the pressure equalization system for GCFR fuel; out-of-pile loop facility test programs; fuels and materials development; fuel, blanket, and control rod analyses and development; nuclear analysis and reactor physics for GCFR core design; shielding requirements for the GCFR; reactor engineering to assess the thermal, hydraulic, and structural performance of the core and the core support structure; plant systems control; systems engineering; development of reactor components, including reactor vessel, control and locking mechanisms, fuel handling equipment, core support structure, shielding assemblies, main helium circulator, steam generator, and auxiliary circulator; development of a helium circulator test facility; reactor safety, environment, and risk analyses, including planning and support of an in-pile and out-of-pile safety test program; nuclear island engineering design; and development of a reliability data bank.

**21585** (HEDL-TME—77-37) **Sodium engineering and technology. Technical progress report, April, May, June 1977.** Atwood, J.M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nov 1977. Contract EY-76-C-14-2170. 142p. .

Progress in LMFBR-related sodium technology studies is reported in the areas of radioactivity control technology, sodium systems technology, safety systems development, and the hydraulics and mechanics program.

**21586** (HEDL-TME—77-38) **Sodium engineering and technology. Technical progress report, July, August, September 1977.** Atwood, J.M. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Dec 1977. Contract EY-76-C-14-2170. 102p. .

Progress in LMFBR-related sodium technology studies is reported in the areas of radioactivity control, sodium systems, hydraulics and mechanics, and safety systems.

**21587** (ORNL/TM—5920) **Status of materials development for molten salt reactors.** McCoy, H.E. Jr. (Oak Ridge National Lab., Tenn. (USA)). Jan 1978. Contract W-7405-ENG-26. 36p. Dep. NTIS, PC A03/MF A01.

Experience to date has shown that in a molten-salt reactor environment the alloy Hastelloy N is embrittled by irradiation and suffers shallow intergranular cracking due to the fission product tellurium. From January 1974 through September 1976 these problems were actively researched. Hastelloy N modified with 1 to 2 percent NB was found to have good resistance to irradiation embrittlement and to intergranular cracking by tellurium. The severity of cracking by tellurium was noted to be influenced by the oxidation state of the salt so that cracking could be prevented even in standard Hastelloy N. This observation opened up other possibilities for materials selection.

**21588** (TID—27816) **Disc-Donut-Tube wear test report, Phase I.** Kowal, K.; Knaus, S.E. (Atomics International Div., Canoga Park, Calif. (USA)). Jun 1976. Contract EY-76-C-03-0824-014. 77p. Dep. NTIS, PC A05/MF A01.

The report describes a test program which simulated the wear-inducing conditions in the AI Prototype CRBR Steam Generator. This was accomplished by simulating the wear inducing loading and motion of a steam tube against "disc-donut" tube spacer plates. It was found that 2-¼ Cr-1 Mo tubes, wearing against 2-¼ Cr-1 Mo tube spacer plates, seized and galled as deep as .017 inches. Inconel 718 tube spacer plates uniformly wore the tubes as deep as .012 in. Aluminum bronze inserts wore as deep as .003 inches into the tube.

**21589** (TID—27895) **Standpipe-bubbler pump level control study system design layout (Task A) W.P. 4413. Engineering memorandum No. 0153.** Salant, R.F.; Cook, M.E. (Borg-Warner Corp., Los Angeles, Calif. (USA). Byron Jackson Pump Div.). 29 Apr 1975. Contract EY-76-C-03-0893-001. 125p. .

Pump tank liquid sodium level control within the specified normal and transient system operating modes utilizing a Standpipe Bubbler was investigated through computerized solution of analytic equations and complemented with testing of a physical model for confidence enhancement of the analytic approach. Sensitivity of pump tank fluid level as a function of: (1) Standpipe Bubbler location, (2) fluid temperature, (3) suction line to tank impedance, (4) cover gas mass flow rate, (5) cover gas system return pressure, and (6) Standpipe Bubbler area and nozzle size is presented in graphical form. Limited testing of the physical model shows close correlation to the computerized model and these data are also presented in graphical form. The preliminary results to date indicate that satisfactory fluid level control can be attained with the Standpipe Bubbler mechanization.

**21590** (WARD—353) **Radial parfait core design study.** Paxson, E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Jun 1977. Contract EY-76-C-03-1141. 205p. .

A study to design a core of the radial parfait (or bullseye) type for PLBR which, through its inherent characteristics, would give assurance that energetic core disruption would not result from transient overpower (TOP) or transient undercooling (TUC) accidents without scram, is described. In addition to the freedom from core disruption, the resulting core design was evaluated with respect to its effect on other reactor characteristics and components such as: thermal hydraulic performance, fuel and blanket assembly mechanical designs and performance, reactor structural design, refueling operation and scheduling, and fuel cycle and capital costs. During the course of the study, two refueling options developed, namely batch refueling on a multi-year cycle and partial core refueling on an annual cycle. Therefore, an additional objective was to make a recommendation relative to these two refueling approaches.

**21591** **Acoustic emission in subcooled nucleate pool boiling.** Nishihara, H.; Bessho, Y. (Kyoto Univ, Jpn). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 407-415(Jun 1977).

The acoustic emission in boiling had frequency components up to and sometimes beyond 50 kHz; the shape of power spectral densities behaved differently for heat fluxes above and below a certain value at which the overall acoustic intensity assumed a maximum value. With the increase in heat flux the acoustic emission increased in high frequencies below this heat flux, while it became eminent in low frequencies above the same heat flux. This phenomenon is related to the transition from the region with single bubbles to the region with coalesced bubbles. 23 refs.

**21592** (JAPFNR—263) **Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle.** Kikuchi, Y.; Ogino, T.; Ozaki, Y.; Inushima, H. (Power Reactor and Nuclear Fuel Development Corp., Oarai (Japan); Mitsubishi Electric Corp., Amagasaki, Hyogo (Japan)). Jun 1977. Translation of PNC-N—943-77-05. (CONF-770640—2). 9p. Dep. NTIS (US Sales Only), PC A02/MF A01.

From 7. liquid metal boiling working group meeting; Petten, Netherlands (1 Jun 1977).

Work performed under United States—Japanese Fast Reactor Exchange Program.

Temperature, flow, and acoustic noises were measured in a locally blocked 37-pin bundle. Comparison of sodium temperature noise obtained in the blocked and unblocked experiments led to the observation that the blockage formation increased the measured root-mean-square (RMS) value by approximately three times in the low frequency ranges (0.1 approximately 10 Hz). Noncondensable gas (argon) entrainment caused a considerable increase in the outlet flow noise measured by an eddy-current type flowmeter. The boiling caused a considerable increase in acoustic noise intensity at all frequencies, particularly in the high frequency ranges (5 approximately 100 kHz).

**21593** **Introduction to materials consideration for LMFBR components.** Morabito, J.J.; Purdy, C.M. (Energy Research and Devel-

opment Administration, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 220-221(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## REGULATION AND LICENSING

**21594** (NUREG—0410) **NRC program for the resolution of generic issues related to nuclear power plants. (Includes plans for the resolution of "unresolved safety issues" pursuant to Section 210 of the Energy Reorganization Act of 1974, as amended).** (Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Reactor Regulation). Dec 1977. 464p. NTIS $14.50.

Report to Congress, January 1, 1978.

This report provides a description of the Nuclear Regulatory Commission's Program for the Resolution of Generic Issues Related to Nuclear Power Plants. The NRC program is of considerably broader scope than the "Unresolved Safety Issues Plan" required by Section 210. The NRC program does include plans for the resolution of "Unresolved Safety Issues"; however, in addition, it includes generic tasks for the resolution of environmental issues, for the development of improvements in the reactor licensing process and for consideration of less conservative design criteria or operating limitations in areas where over conservatisms may be unnecessarily restrictive or costly.

**21595** (PB—270463) **Water supplies and the nuclear licensing process.** Davenport, F.S. (Water Resources Council, Washington, D.C. (USA)). Jul 1977. Contract NRC-06-77-068. 168p.

This study was designed to surface state views on water management and permit processes for nuclear facilities. It was concluded that water planning and management is continuous in the states and when water needs are integrated with other energy facilities plans, there should be no delay from state permit actions. To accomplish this, NRC, other Federal agencies, states and utilities must show plans early, and consult with each other. NRC should solicit from the states water permit needs of facilities as soon as a facility is being considered. Such an action may be the only new coordination needed. States should have the opportunity to involve themselves in the licensing process in specific ways as defined by NRC. This may be through statements developed by the states in conjunction with the NRC licensing process, or by the A-95 and NEPA Environmental Impact Statement process. In any event, the issues must be resolved to the state's satisfaction in order to prevent delays. Formal processes are not a substitute for early coordination among the parties. States should have final authority in siting.

## ECONOMICS

**21596** (COO—2477-13(Vol.1)) **Commercial electric power cost studies. Capital cost, Pressurized Heavy Water Reactor Plant.** (United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)). Jun 1977. Contract EY-76-C-02-2477. 388p. Dep. NTIS, PC A17/MF A01.

An investment cost study for a 1100 MW(e) pressurized heavy water reactor (PHWR) central station power plant is described. Cost differentials relative to a PWR plant are presented.

**21597 On the complex analysis of the reliability, safety, and economic efficiency of atomic electric power stations.** Emel'yanov, I.Ya.; Klemin, A.I.; Polyakov, E.F. *Power Eng.;* **15**: No. 1, 9-15(1977).

The problem is posed of effectively increasing the engineering performance of nuclear electric power stations (APS). The principal components of the engineering performance of modern large APS are considered: economic efficiency, radiation safety, reliability, and their interrelationship. A nomenclature is proposed for the quantitative indices which most completely characterize the enumerated properties and are convenient for the analysis of the engineering performance. The urgent problem of developing a methodology for the complex analysis and optimization of the principal performance components is considered; this methodology is designed to increase the efficiency of the work on high-performance competitive APS. The principle of complex optimization of the reliability, safety, and economic-efficiency indices is formulated; specific recommendations are made for the practical realization of this principle. The structure of the complex quantiative analysis of the enumerated performance components is given. The urgency and promise of the complex approach to solving the problem of APS optimization is demonstrated, i.e., the solution of the problem of creating optimally reliable, fairly safe, and maximally economically efficient stations.

**21598 Dispatch of nuclear power plants.** Rahman, S.; Grigsby, L.L. (Va Polytech Inst and State Univ, Blacksburg). pp 564-567 of In Proceedings of the Institute of Electrical and Electronics Engineers conference. New York; Institute of Electrical and Electronics Engineers (1977).

From Institute of Electrical and Electronics Engineers conference; Williamsburg, VA, USA (4 Apr 1977).

A review of the state of the art with regard to the dispatching of the electric power of nuclear power plants considering the flexibilities of the nuclear fuel cycle is presented. A summary of the status of previous research results is given and needed research is outlined. 8 refs.

### CONSTRUCTION AND OPERATION

**21599 Dynamical analysis of processes substituting fossil energy.** Seifritz, W. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). *Trans. Am. Nucl. Soc.;* **27**: 2-4(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## PROCESS HEAT REACTORS

*REFER ALSO TO CITATION(S) 20864, 21246, 21247*

**21600 Nuclear power generation.** Hill, J. (UKAEA, Engl). *Phys. Technol.;* **8**: No. 4, 152-156(Jul 1977).

The problems of nuclear power are, in practice, very different from those commonly portrayed. Here the Chairman of the UKAEA and British Nuclear Fuels answers the critics of nuclear power on the vital issues of safety, proliferation and theft.

**21601 Method of combining diesel-generator set detailed component models into a composite model.** Pearce, W.S. (South Co Serv, Inc, Birmingham, Ala). pp 16-20 of In Proceedings of the Institute of Electrical and Electronics Engineers conference. New York; Institute of Electrical and Electronics Engineers (1977).

From Institute of Electrical and Electronics Engineers conference; Williamsburg, VA, USA (4 Apr 1977).

The ability to calculate accurately the dynamic response of a diesel-generator set used in nuclear power plants is of increasing importance today. A description is given of a method of combining detailed component models into a composite diesel generator set model which can then be programmed into a digital computer for calculating accurate and rapid results. 7 refs.

## NUCLEAR REACTOR TECHNOLOGY

*REFER ALSO TO CITATION(S) 21554*

**21602 Training and career plan for engineers in the nuclear industry.** Stoll, G.J.; Hubbard, J.L. (Babcock and Wilcox Co., Lynchburg, VA). *Trans. Am. Nucl. Soc.;* **27**: 100-101(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21603 Brazilian special master's program: an experience.** Couto de Almeida, C.U. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, Brazil). *Trans. Am. Nucl. Soc.;* **27**: 101(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21604 Experience with team-teaching at the University of Illinois.** Carbajo, J.J.; Hang, D.F. (Univ. of Illinois, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 101-102(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21605 Reliability course for nuclear engineering students.** Hockenbury, R.W. (Rensselaer Polytechnic Inst., Troy, NY). *Trans. Am. Nucl. Soc.;* **27**: 102-103(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21606 Engineers must become more aware of public acceptance.** Dernbach, N.J. (Dernbach Associates, Miller Place, NY). *Trans. Am. Nucl. Soc.;* **27**: 103-104(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21607 Development of a nuclear engineering computer code workshop.** Ching, J.T. (Energy Inc., Idaho Falls, ID); Grossman, L.M. *Trans. Am. Nucl. Soc.;* **27**: 104-105(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21608 Course in quality assurance, nondestructive testing, and nuclear standards.** Yeater, M.L. (Rensselaer Polytechnic Inst., Troy, NY). *Trans. Am. Nucl. Soc.;* **27**: 107(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## THEORY AND CALCULATION

*REFER ALSO TO CITATION(S) 21618, 21626, 22385*

## COMPONENTS AND ACCESSORIES

*REFER ALSO TO CITATION(S) 21481, 21651*

**21609 Significance of hydraulic testing of reactor pressure vessels from the standpoint of fracture mechanics.** Stahlberg, R. (Tech Ueberwach-Ver Rhein, Cologne, Ger). *VGB Kraftwerkstech.;* **57**: No. 8, 559-566(Aug 1977). (In German).

Hydraulic testing represents a special case for stresses in reactor pressure vessels occurring under operating and breakdown conditions in the course of an operating period, since it is usually carried out at a temperature which is lower than the lowest possible operating temperature and leads to maximum stresses at the inner corner of the coolant outlet connection as the most critical point. In order to attain a fracture mechanics appraisal of the hydraulic test in relation to subsequent crack growth, it has been assumed in the first approximation that this test represents a single overloading and furthermore has displayed only a constant cyclic stress. Under these assumptions experiments have been evaluated in which the effect of crack growth delay on further fatigue crack growth in a low alloy ferritic steel has been examined by single and multiple overloading. 14 refs.

**21610 Influence of specifically nuclear phenomena on the selection of metallic materials.** Weisz, M. (CEA, Cent d'Etud Nucl, Saclay, Fr). *Mater. Tech.;* **65**: No. 6, 311-320(Jun 1977). (In French).

The effects of neutron irradiation on the metal structures of nuclear reactors are studied. A type of defect called "unidentified clusters," found at low temperature and low fluxes, prevails in steels for reactor vessels and in the internal structures of water reactors, giving rise to hardening and embrittlement. The phenomena induced by irradiation at intermediate temperatures and very high fluxes are the formation of very specific submicroscopic cavities and creep. Their greatest effects are on the cladding for the fuel elements of fast reactors. Finally, a high-temperature domain is indicated in which the helium produced by nuclear reactions precipitating at the grain boundaries gives rise to hot intergranular brittleness.

**21611 Experience of operation of saturated steam turbines of nuclear power plants.** Troyanovskii, B.M.; Kosayk, Yu.F.; Pankov, I.I.; Sukharev, F.M.; Kelin, G.E. (Minenergo SSR). *Teploenergetika (Moscow);* No. 2, 14-22(Feb 1977). (In Russian).

Specific features of saturated steam turbines which have caused many failures of turbine equipment both in the USSR and abroad are considered. Above all, the effect of wet steam which causes erosion and corrosion wear is examined. Secondly, following steam consumption changes, phase transitions may bring about considerable temperature gradients. Thirdly, there are considerable thermal stresses in some nuclear power plant installations. Reliability indices are considered and breakdowns of turbines made by Kharkov Turbogenerator Plant and of foreign-made ones are analyzed. It is concluded that, statistically, the number of breakdowns of nuclear power plant turbines is no higher than that of fossil-fired plants but these breakdowns are more costly. The saturated steam turbines require further improvements, and consequently, further research is necessary. 25 refs.

**21612 Instrumentation for the measurement of vibration in severe environments, such as nuclear reactors.** Bierney, T.K. (Endevco UK Div, Royston, Hertfordshire, Engl). pp 103-116 of In Conference on the operation of instruments in adverse environments. London; Institute of Physics (1977).

From Conference on the operation of instruments in adverse environments; London, UK (4 Oct 1976).

See CONF-7610120—.

The measurement of vibration and pressure (including acoustic levels) in hostile environments such as those found in generation of nuclear power presents many special problems. Transducers may be required to operate in environments composed of a combination of high temperature, high pressure, high acoustic levels, high radiation exposure and a corrosive atmosphere. These hostile environments can present a challenge to the transducer designer in terms of materials to be used and the mounting of the transducers. the challenge extends further as the transduced signal must be transmitted to monitoring equipment outside the hostile environment. The signal conditioning of transducers used at high temperature also requires careful design to obtain useful data. For example, conventional charge amplifiers may be unusuable with transducers at high temperature due to the sensing element of the transducer undergoing severe changes in its characteristics. The types of vibration transducer for a nulcear reactor environment, the design of suitable piezoelectric transducers and the signal transmission and conditioning are discussed. 11 refs.

**21613 Modeling and analysis for seismic adequacy in air handling unit enclosures.** Zorowski, C.F.; Nau, J.M. (NC State Univ, Raleigh). *Am. Soc. Mech. Eng., [Pap.];* No. 77-DET-136, 1-8(1977).

One consideration in the effort to insure safety at nuclear power plants subjected to seismic shocks is to assure continuous functioning of the air conditioning system to protect personnel and control equipment which may be environmentally sensitive. This paper investigates the effects of structural reinforcement on the seismic adequacy of air handling unit enclosures by focusing on their expected frequency response during seismic excitation. Analytical results are presented which describe how the natural frequencies of the units vary with enclosure dimensions, internally mounted component mass, and bracing stiffness and geometry.

**21614 Reliability engineering, why do we need it.** Williams, R.L. (GPU Service Corp., Parsippany, NJ). *Trans. Am. Nucl. Soc.;* **27**: 98-99(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## FUEL ELEMENTS

*REFER ALSO TO CITATION(S) 21626*

**21615 Methods and correlations for the prediction of quenching rates on hot surfaces.** Yu, S.K.W.; Farmer, P.R.; Coney, M.W.E. (Cent Electr Res Lab, Leatherhead, Surrey, Engl). *Int. J. Multiphase Flow;* **3**: No. 5, 415-443(Aug 1977).

A substantial quantity of experimental data on rewetting, much of which has not been previously reported, is analyzed using the results of calculations of the two-dimensional conduction processes taking place in the walls of tubes, which have been used to simulate the cladding of nuclear fuel elements. Correlations giving the quenching heat-transfer coefficient and sputtering temperature are proposed as a result of the analysis. The new data include falling film rewetting rates. Measurements have also been made of rewetting rates by bottom flooding of both saturated and subcooled water at atmospheric pressure. 19 refs.

**21616 Stress corrosion cracking of Zircaloy-2 cladding in iodine vapor.** Une, K. (Tokyo Shibaura Electr Co, Ltd, Kawasaki, Jpn). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 443-451(Jun 1977).

Iodine stress corrosion cracking of Zircaloy-2 cladding under static tensile stress has been studied over the temperature range of 250 similar 450°C. The lowest iodine concentration required to cause cracking wa 0.15 mg iodine per $cm^3$ free volume in test ampoule at 300°C, and 1.1mg/$cm^3$ at 350°C. The minimum circumferential plastic strain to cause failure was about 0.4% for specimen tubes possessing high cracking susceptibility. Cracking was also inhibited by the presence of oxygen in the iodine atmosphere, the threshold partial pressures being 28 torr at 300°C and 9 torr at 350°C. 20 refs.

## CONTROL SYSTEMS

**21617 Suboptimal control of a nuclear reactor using functional analysis.** Nieva, R.; Christensen, G.S.; El-Hawary, M.E. (Univ of Alberta, Edmonton). *Int. J. Control;* **26**: No. 1, 145-156(Jul 1977).

A functional optimization technique based on the abstract minimum norm problem in Hilbert spaces is applied to obtain a suboptimal control policy for the problem of adjusting the flux distribution, in finite time. Restricting the control action to be expanded in terms of a finite set of arbitrary known functions of time, the infinite dimensional control problem is reduced to a finite dimensional one. The control action is subject to linear constraints. The method is described for a general, linearized, distributed reactor model. An example is presented. 10 refs.

**21618 Proposal of a method for estimating multiple-rod worth by single-rod experiments.** Nakano, M. (Jpn At Energy Res Inst, Ibaraki-ken, Jpn). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 457-459(Jun 1977).

Konishi et al. recently reported a disturbance parameter method of predicting the multiple-rod worth from information obtained by single-rod worth calculation. For experiments, however, the method is not practical, since it requires flux and importance mappings for the reactor. In this note, a simple method is presented. 1 ref.

**21619 Backup computer theory for process control computer systems.** Davidson, K.E. (Westinghouse Electr Corp, Pittsburgh, Pa). pp 129-133 of In Institute of Electrical and Electronics Engineers conference. New York; Institute of Electrical and Electronics Engineers (1977).

From Institute of Electrical and Electronics Engineers conference; San Francisco, CA, USA (28 Feb 1977).

Process control computer systems should have some type of back-up system which could automatically assume control of a process if the main computer system should fail. This subject is discussed in general and as relates to a specific process. This process is the computer control system for the Almarez Nuclear Power Plant installation at Almarez in Spain. The system configuration includes two main computer control systems, with one backup system which can replace either of the main systems. Criteria for determining an adequate backup system will be discussed including cost, reliability, and criticality of the computer system and process.

## ENVIRONMENTAL ASPECTS

*REFER ALSO TO CITATION(S) 21481, 22210, 22260*

**21620 Financing nuclear power plant pollution controls.** Iacovino, J.M. Jr. (Westinghouse Electric Corp., Pittsburgh). *Trans. Am. Nucl. Soc.;* **27**: 137-139(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### SITING

*REFER ALSO TO CITATION(S) 22229*

**21621 State side of the siting equation: some case studies.** Ryan, R.G. *Nucl. Saf.;* **19**: No. 1, 1-9(1978).

The article is a brief survey of state activities in the siting of nuclear production and utilization facilities.

**21622 Territorial and engineering requirements in nuclear stations siting.** Dellarciprete, C.; Morelli, V. (Ente Naz per l'Eneg Elettr, Italy). *Elettrotecnica;* **64**: No. 5, 329-339(May 1977). (In Italian).

The large number of factors involved in the determination of nuclear power plants siting makes it necessary to select the site according to a step-wise procedure based on successive introductions of various discriminating factors that gradually reduce the alternatives. The first selection is performed by taking into examination a number of factors, called "primary factors", that characterize the territory in broad lines. The sites thus chosen are then subjected to further screening on the basis of the engineering requirements.

### RADIOACTIVE EFFLUENTS

*REFER ALSO TO CITATION(S) 21177, 22196, 22227*

**21623 (NUREG—0384) Procedures: Source Term Measurement Program.** Dyer, N.C.; Keller, J.H.; Nieschmidt, E.B.; Motes, B.J. (Idaho National Engineering Lab., Idaho Falls (USA)). Oct 1977. 73p. NTIS $6.00.

The report contains procedures for the Source Term Measurement Project being performed by Idaho National Engineering Laboratory for the Nuclear Regulatory Commission. This work is being conducted for the Office of Nuclear Regulatory Research in support of requirements of the Effluent Treatment Systems Branch of the Office of Nuclear Reactor Regulation. This project is designed to obtain source term information at operating light water reactors to update the parameters used in NRC calculational models (GALE codes). Detailed procedures and methods used for collection and analysis of samples are presented. This provides a reference base to supplement a series of reports to be issued by the Source Term Measurements Project which will present data obtained from measurements in specific nuclear power stations. Reference to appropriate parts of these procedures will be made as required.

**21624 Procedures employed and future development trends for waste gas purification plants for light water reactors.** Gutowski, H. (Linde, TVT Muenchen, Ger). *VGB Kraftwerkstech.;* **57**: No. 7, 460-463(Jul 1977). (In German).

Procedures used to prevent the buildup of explosive gas mixtures and to reduce the activity of radioactive decay products are described. Using as an example a waste gas purification system currently under construction which employs these procedures, it is shown how decontamination of the waste gases of an 1100-MW pressurized water reactor can be achieved. Future developmental trends in absorptive retardation of inert gases at low temperatures and distillation separation of krypton 85 are indicated.

### CHEMICAL AND THERMAL EFFLUENTS

*REFER ALSO TO CITATION(S) 22216, 22229*

## RESEARCH, TEST, AND EXPERIMENTAL REACTORS

*REFER ALSO TO CITATION(S) 21585, 21586*

**21625 (SAND—77-1116C) Recent operational history of the new Sandia Pulsed Reactor III (SPR III).** Schmidt, T.R.; Estes, B.F.; Reuscher, J.A. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 10p. (CONF-771109—38). Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

The Sandia Pulsed Reactor III (SPR III) is a fast-pulse research reactor which was designed and built at Sandia Laboratories and achieved criticality in August 1975. The reactor is now characterized and is in an operational configuration. The core consists of 18 fuel plates (258 kg fuel mass) of fully enriched uranium alloyed with 10 wt.% molybdenum. It is arranged in an annular configuration with an inside diameter of 17.78 cm, an outside diameter of 29.72 cm, and a height of 35.9 cm. The reactor core uses reflectors of copper and aluminum for control and an external bolting arrangement to secure the fuel plates. SPR III and SPR II are operated on an interchangeable basis using the same facility and control system. As of June 1977, SPR III has had over 240 operations with core temperatures up to 541°C.

**21626 Measurement of anisotropy of diffusion coefficient in plate cell.** Shirakata, K.; Iijima, T. (Jpn At Energy Res Inst, Ibaraki-ken). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 462-464(Jun 1977).

Results show that the anisotropy of diffusion coefficient in a plate lattice assembly can be accurately measured by means of an integral measurement, i.e. a reactivity change due to turning of the plate direction, and that the measured anisotropy is useful to examine the method of calculation of directional diffusion coefficients in plate lattice. 2 refs.

**21627 Operation of a nuclear test gauge at low multiplications.** Baumann, N.P. (Savannah River Lab., Aiken, SC). *Trans. Am. Nucl. Soc.;* **27**: 183-184(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## PROPULSION REACTORS

**21628 (PB—269723) Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 1. Preliminary specifications (Mod 1). Final report.** (Newport News Shipbuilding and Dry Dock Co., Va. (USA)). Dec 1975. Contract MA-5-38022. 505p. NTIS PC A22/MF A01.

The study extended over a period of approximately six months. The principal objectives of the study were to develop the preliminary design for a 600,000 DWT nuclear powered ULCC, perform ship safety analyses, develop a preliminary quality assurance program, develop a ship construction schedule of key events, develop the shipyard/reactor manufacturer scope of supply, define the interfaces specifically related to the nuclear propulsion plant. In terms of budgetary estimates, an economic evaluation was performed for ship construction cost, ship refueling and drydocking cost, first of a kind ship construction cost, ship manning cost, and contingencies. Additionally, recommendations are made as a result of the ship safety studies.

**21629** (PB—269724) **Nuclear powered tanker. maritime design study for 600,000 DWT nuclear tanker. Volume 2. Preliminary design. Final report.** (Newport News Shipbuilding and Dry Dock Co., Va. (USA)). Dec 1975. Contract MA-5-38022. 236p. NTIS PC A11/MF A01.

The study extended over a period of approximately six months. The principal objectives of the study were to develop the preliminary design for a 600,000 DWT nuclear powered ULCC, perform ship safety analyses, develop a preliminary quality assurance program, develop a ship construction schedule of key events, develop the shipyard/reactor manufacturer scope of supply, define the interfaces specifically related to the nuclear propulsion plant.

**21630** (PB—269725) **Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 3. Ship safety. Final report.** (Newport News Shipbuilding and Dry Dock Co., Va. (USA)). Dec 1975. Contract MA-5-38022. 379p. NTIS PC A17/MF A01.

The study extended over a period of approximately six months. In terms of budgetary estimates, an economic evaluation was performed for ship construction cost, ship refueling and drydocking cost, first of a kind ship construction cost, ship manning cost, and contingencies. Additionally, recommendations are made as a result of the ship safety studies.

**21631** (PB—269726) **Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 4. Engineering and production support. Final report.** (Newport News Shipbuilding and Dry Dock Co., Va. (USA)). Dec 1975. Contract MA-5-38022. 170p.

The study extended over a period of approximately six months. The principal objectives of the study were to develop the preliminary design for a 600,000 DWT nuclear power ULCC, perform ship safety analyses, develop a preliminary quality assurance program, develop a ship construction schedule of key events, develop the shipyard/reactor manufacturer scope of supply, define the interfaces specifically related to the nuclear propulsion plant.

**21632** (PB—269727) **Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 5. Economic evaluation. Final report.** (Newport News Shipbuilding and Dry Dock Co., Va. (USA)). Aug 1976. Contract MA-5-38022. 128p. NTIS PC A07/MF A01.

The study extended over a period of approximately six months. The principal objectives of the study were to develop the preliminary design for a 600,000 DWT nuclear powered ULCC, perform ship safety analyses, develop a preliminary quality assurance program, develop a ship construction schedule of key events, develop the shipyard/reactor manufacturer scope of supply, define the interfaces specifically related to the nuclear propulsion plant. In terms of budgetary estimates, an economic evaluation was performed for ship construction cost, ship refueling and drydocking cost, first of a kind ship construction cost, ship manning cost, and contingencies.

**21633** **Voyager: running a planetary post pattern.** Zimmerman, M.D. *Mach. Des.;* **49**: No. 19, 27-30(25 Aug 1977).

Voyager represents a new class of vehicle for exploring planets in regions characterized by faint sunlight and vast radio distances. Nuclear "miniplants" rather than solar cells supply electricity to the spacecraft. Three command computers, with fault-fixing capabilities, make Voyager more automatic and independent of earth control than any previous planetary spacecraft.

## REACTOR SAFETY

*REFER ALSO TO CITATION(S) 21215, 21615*

**21634** (CENPD—258) **Safety-related research and development for C-E pressurized water reactors. 1976 program summaries.** (Combustion Engineering, Inc., Windsor, Conn. (USA)). Oct 1977. 74p. Engineering, Inc., Windsor, CT.

Short descriptions of safety-related research and development programs which are applicable to Combustion Engineering pressurized water reactors are presented. The program summaries give an overview of C-E's safety-related R and D program and reference specific topical reports and publications.

**21635** (CRBRP-ARD—0185(Vol.1)) **Clinch River Breeder Reactor Plant. Integrity of primary and intermediate heat transport system piping in containment.** Mallett, R.H.; Nair, B.R. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1977. Contract EY-76-C-15-1200;EY-76-C-15-2395. 330p.

A comprehensive and detailed assessment of the primary and intermediate Heat Transport System (HTS) piping in containment has led to the conclusion that the integrity of this HTS piping is assured such that there is a negligible likelihood of a large break. This conclusion is based upon the following: (1) The overall system design incorporates many features which prevent the occurrence, and limit the consequences, of leaks in this HTS piping; (2) The highest quality engineering standards are applied by the HTS Piping Design Specification which provides a complete basis for construction including the materials, design, fabrication, examination, testing, inspection and certification; (3) A comprehensive quality assurance program assures that the specified engineering standards are met throughout the construction, installation, operation and maintenance of this HTS piping; (4) A compilation of operating experience with liquid metal piping governed by various quality standards has shown that, although fatigue crack leakage incidents have occurred, no large breaks have occurred in liquid metal piping; (5) A detailed structural design analysis has shown that the piping will comply with all of the Design Specifications and ASME Code requirements for Class 1 piping; (6) A detailed fracture mechanics evaluation has shown that significant fatigue crack propagation will not occur during the entire plant lifetime even if an initial defect much larger than quality standards allow is postulated; and (7) A comprehensive technology program has shown that even if a defect did grow significantly, it would penetrate the pipe wall and result in detectable leakage without risk of a large break in this HTS piping.

**21636** (DOE/ET—0009) **Compendium of computer codes for the safety analysis of fast breeder reactors.** (Department of Energy, Washington, D.C. (USA). Div. of Reactor Research and Development). Oct 1977. 432p. Dep. NTIS, PC A14/MF A01.

The objective of the compendium is to provide the reader with a guide which briefly describes many of the computer codes used for liquid metal fast breeder reactor safety analyses, since it is for this system that most of the codes have been developed. The compendium is designed to address the following frequently asked questions from individuals in licensing and research and development activities: (1) What does the code do. (2) To what safety problems has it been applied. (3) What are the code's limitations. (4) What is being done to remove these limitations. (5) How does the code compare with experimental observations and other code predictions. (6) What reference documents are available.

**21637** (EPRI-NP—135) **One-Third-Scale Air—Water Pump Program: test program and pump performance.** Winks, R.W. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Jul 1977. 196p. Dep. NTIS, PC A09/MF A01.

Steady-state values of pump head and torque for a 10-inch-diameter pump were measured for various mixtures of air and water. The pump is a one-third-scale test model of a reactor coolant pump. A number of steady-state test conditions were established at the inlet to the pump to determine the degradation of pump single-phase head and torque over a range of void fractions from 0 to 90%. The selected test conditions represented the first three quadrants of the pump performance map. Measured values of pump head and torque at known pump airwater flow rates and speeds were converted to dimensionless homologous values to develop a map displaying the transition from fully developed to fully degraded pump head and torque as a function of pump inlet void fraction.

**21638** (EPRI-NP—385(Vol.1)) **One-Third-Scale Air—Water Pump Program, alternate analytical pump performance data.** Treventi, P.A.; Cudlin, J.J.; Parks, C.E. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Dec 1977. 38p. Dep. NTIS, PC A03/MF A01.

The report presents an alternate version of the analytical model for reactor coolant pump behavior during two-phase flow conditions reported in EPRI NP-160. This alternate version was developed based on the data set obtained from a revised reduction of the steady-state data collected during the testing of a 1/3-scale reactor coolant pump using air—water mixtures. Like the first model presented in EPRI NP-160, the alternate version relates the single-phase homologous characteristics of the pump to the corresponding two-phase parameters through multiplier functions of the average void fraction.

**21639** (EPRI-NP—474) **One-Third-Scale Air—Water Pump Program, LOCA and pump overspeed analyses. Final report.** Jones, R.C. Jr.; Jones, C.W.; Parks, C.E. (Babcock and Wilcox Co., Lynch-

burg, Va. (USA). Nuclear Power Generation Div.). Oct 1977. 55p. Dep. NTIS, PC A04/MF A01.

A pump model developed from air—water test data (the B and W air—water pump model) was incorporated into the CRAFT2 computer code, which is used to solve the evolution of system hydrodynamics and core power generation during the blowdown phase of a hypothetical loss-of-coolant accident. Peak cladding temperature calculations were performed for several break sizes and configurations using this pump model. The results of these calculations were compared to previously calculated results for B and W's 205-fuel assembly plants obtained using the same CRAFT model but one that used a pump model developed from the Semiscale data. The newly calculated peak cladding temperatures were essentially the same as those obtained previously. Pump overspeed calculations were also performed for B and W's 205-fuel assembly plants using the B and W air—water pump model. The use of a realistic discharge coefficient of 0.6 resulted in a peak speed of 3007 rpm, 253% of rated speed, for an 8.55-ft² double-ended break in the pump discharge piping. This result agrees reasonably well with the overspeed calculation performed in 1973 for B and W's 177-fuel assembly plants, which did not include pump head or torque degradation as a function of void fraction. Therefore, it appears that overspeed calculations are basically unaffected by the use of the B and W air—water pump model.

**21640** (N—77-26550) **Failure analysis of pressure vessels with defects. Progress report, September 1976.** Hodkinson, P.H. (Oxford Univ. (UK). Dept. of Engineering Science). Sep 1976. 25p. (OUEL—1168/76). NTIS PC A02/MF A01.

Results obtained from tests performed since 1974 on plate specimens of maraging steel are summarized. These results show the effects of thickness on the fracture toughness and slow crack growth characteristics of the steel and indicate that, from the point of view of design, Dowling and Townley's two-criteria approach to failure is valid provided due allowance is made for slow crack growth.

**21641** (N—77-26941) **Microcomputer-based reactor safety system.** Cope, S.N. (Oxford Univ. (UK). Dept. of Engineering Science). Jul 1976. 35p. (OUEL—1159/76). NTIS PC A03/MF A01.

A modular system consisting of microprocessors is proposed for control of reactor safety. The microprocessor CPU's are best checked by means of hardware. Hardware comparison of two microprocessors operating in synchronism allows errors to be detected during operation of the functional program and does not detract from its efficiency. The hardware can be made reliable through a conbination of self-checking and redundancy. In addition, it can monitor all memory and I/O data transfers by monitoring the 8-bit data bus. Programs were developed to perform the various tasks required by the reactor safety system.

**21642** (NUREG—0264-4) **Suppression pool dynamics. Quarterly progress report, April 1—June 30, 1977.** Catton, I.; Chan, C.K.; Dhir, K.; Chiou, H.H.; Lee, C.K.B. (California Univ., Los Angeles (USA). Dept. of Chemical, Nuclear, and Thermal Engineering). Sep 1977. 55p. NTIS $5.25.

The report represents the results of transient air-water tests conducted to investigate the basic hydrodynamics of phenomena that can be experienced in a BWR pressure suppression pool at the onset of a loss-of-coolant accident. The tests were performed in a cylindrical plexiglas test chamber. Air or other gases were injected downward through pipes of 46 mm diameter placed in the middle of the test chamber, containing water at room temperature.

**21643** (ORNL/NUREG/TM—124) **Source term assessment concepts for LMFBRS: Aerosol Release and Transport (ART) Analytical Program.** Kress, T.S. (Oak Ridge National Lab., Tenn. (USA)). Nov 1977. Contract W-7405-ENG-26. 72p. Dep. NTIS, PC A04/MF A01.

Analytical needs for LMFBR HCDA source term assessment are outlined and the physical events connected with the formation of an aerosol source are discussed. The important features of the movement of hazardous materials from the core site to the boundaries of the secondary containment are described, with accompanying brief reviews of prior work. The overall problem is broken down into tractable parts and approaches for attacks on the various problems are suggested. Topics include the state of the disrupted core, interactions with intact above-core structure, HCDA bubble formation, heat exchange with the sodium pool, aerosol formation by nucleation and fragmentation, attentuation effects, and aerosol behavior in secondary containments.

**21644** (SAND—76-0614) **Flow visualization in heat-generating porous media.** Lee, D.O.; Nilson, R.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0789. 33p. Dep. NTIS, PC A03/MF A01.

The work reported is in support of the Sandia Post-Accident Heat Removal Program, in which simulated LMFBR beds will be subjected to in-pile heating in the ACPR (Annular Core Pulsed Reactor). Flow visualization experiments were performed to gain some insight into the flow patterns and temperature distributions in a fluid-saturated heat-generating porous medium. Although much of the information presented is of a qualitative nature, it is useful in the recognition of the controlling transport process and in the formulation of analytic and numerical models.

**21645** (TREE-NUREG—1124) **Experiment data report for semiscale Mod-1 test S-06-4 (LOFT counterpart test).** Gillins, R.L.; Sackett, K.E.; Coppin, C.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1977. Contract EY-76-C-07-1570. 265p. Dep. NTIS, PC A16/MF A01.

Recorded test data are presented for Test S-06-4 of the Semiscale Mod-1 LOFT counterpart test series. These tests are among several Semiscale Mod-1 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident in a pressurized water reactor (PWR) system. Test S-06-4 was conducted from initial conditions of 15,653 kPa and 564 K to investigate the response of the Semiscale Mod-1 system to a depressurization and reflood transient following a simulated double-ended offset shear of the broken loop cold leg piping. During the test, cooling water was injected into the cold leg of the intact loop to simulate emergency core coolant injection in a PWR. The heater rods in the electrically heated core were operated at an axial peak power density which was 100 percent of the maximum peak power density (52.5 kW/m).

**21646** (TREE-NUREG—1137) **Posttest REALP4 analysis of LOFT experiment L1-3A.** White, J.R.; Holmstrom, H.L.O. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1977. Contract EY-76-C-07-1570. 207p. MN A01.

Portions of document are illegible.

This report presents selected results of posttest RELAP4 modeling of LOFT loss-of-coolant experiment L1-3A, a double-ended isothermal cold leg break with lower plenum emergency core coolant injection. Comparisons are presented between the pretest prediction, the posttest analysis, and the experimental data. It is concluded that pressurizer modeling is important for accurately predicting system behavior during the initial portion of saturated blowdown. Using measured initial conditions rather than nominal specified initial conditions did not influence the system model results significantly. Using finer nodalization in the reactor vessel improved the prediction of the system pressure history by minimizing steam condensation effects. Unequal steam condensation between the downcomer and core volumes appear to cause the manometer oscillations observed in both the pretest and posttest RELAP4 analysis.

**21647** (TREE-NUREG—1151) **Experiment data report for semiscale Mod-1 test S-28-4 (steam generator tube rupture test).** Esparza, V.; Sackett, K.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1977. Contract EY-76-C-07-1570. 292p. Dep. NTIS, PC A13/MF A01.

Recorded test data are presented for Test S-28-4 of the Semiscale Mod-1 steam generator tube rupture test series. These tests are among several Semiscale Mod-1 experiments conducted to investigate the thermal and hydraulic phenomena accompanying a hypothesized loss-of-coolant accident in a pressurized water reactor (PWR) system. Test S-28-4 was conducted from initial conditions of 15 646 kPa and 557 K to investigate the response of the Semiscale Mod-1 system to a depressurization and reflood transient following a simulated double-ended offset shear of the broken loop cold leg piping. During the test, cooling water was injected into the cold leg of the intact and broken loops to simulate emergency core coolant injection in a PWR. Thirty steam generator tube ruptures were simulated by a controlled injection from a heated accumulator into the intact loop hot leg.

**21648** (TREE-NUREG—1188) **Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, July—September 1977.** (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1977. Contract EY-76-C-07-1570. 106p. Dep. NTIS, PC A06/MF A01.

The Semiscale Mod- 1 Program completed all tests currently scheduled for the Mod- 1 system and also completed the posttest analysis and report writing for the alternate emergency core coolant (ECC) test series and the Loss-of-Fluid Test (LOFT) counterpart test series. In the LOFT Program, a study was completed as part of the Loss-of Coolant Experiment (LOCE) L1-4 posttest analysis to determine the flow behavior of ECC injected into the LOFT intact loop cold leg during the LOCE. Downcomer modeling techniques using the RELAP4 computer code were evaluated, and a split downcomer nodalization was found to provide a more realistic calculation of overall system behavior during a LOCE than could be obtained using the conventional "single downcomer" nodalization. The Thermal Fuels Behavior Program activities included performance of the initial natural burst testing of the Power Burst Facility (PBF) reactor to determine the natural burst performance characteristics of the PBF core and to evaluate the behavior of a PBF fuel rod subjected to enthalpies in excess of that generated in the hottest core

rods. Postirradiation examination of failed BWR fuel rods shows substantial fuel rod damage apparently resulting from gross secondary hydriding. In the Reactor Behavior Program, work continued on the development and checkout of the BEACON/MOD2 containment code and the verification of versions of the RELAP4 code that are used for transient thermal-hydraulic analysis of nuclear reactors and related experimental systems. The 3-D Experiment Project was expanded to include (a) a small-scale upper plenum reflood simulation using the Semiscale air-water loop, and (b) fabrication of specialized instrumentation for the German and Japanese large-scale reflood experiments.

**21649** (UCID—17661) **BWR Mark I pressure suppression study: bench mark experiments.** Lai, W.; McCauley, E.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jan 1977. Contract W-7405-ENG-48. 47p. Dep. NTIS, PC A03/MF A01.

Computer simulations representative of the wetwell of Mark I BWR's have predicted pressures and related phenomena. However, calculational predictions for purposes of engineering decision will be possible only if the code can be verified, i.e., shown to compute in accord with measured values. Described in the report is a set of single downcomer spherical flask bench mark experiments designed to produce quantitative data to validate various air-water dynamic computations; the experiments were performed since relevant bench mark data were not available from outside sources. Secondary purposes of the study were to provide a test bed for the instrumentation and post-experiment data processing techniques to be used in the Laboratory's reactor safety research program and to provide additional masurements for the air-water scaling study.

**21650** (UCID—17662) **BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function.** Lai, W.; McCauley, E.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Feb 1977. Contract W-7405-ENG-48. 18p. Dep. NTIS, PC A02/MF A01.

The investigation reported forms a part of the BWR Mark I Pressure Suppression Experiment Program and is one of a series of small scale studies designed to evaluate limited aspects of the pool dynamics phenomena prior to conduct of the 1/5 scale air test series. Presented is an experimental study of the effect of downcomer fill level (DFL) on the vertical load function (VLF).

**21651** **Thermal shock studies associated with injection of emergency core coolant following a loss-of-coolant accident in PWRs.** Cheverton, R.D. *Nucl. Saf.;* **19**: No. 1, 10-19(1978).

The thermal shock resulting from injection of emergency core coolant following a loss-of-coolant accident may, under certain circumstances, result in propagation of preexisting cracks on the inner surface of pressurized-water-reactor (PWR) pressure vessels. At Oak Ridge National Laboratory, studies being conducted in connection with this problem include the thermal shock testing of 533-mm-OD by 241-mm-ID steel test specimens. Four experiments have been conducted thus far. The results have revealed no significant anomalies and tend to validate with reasonable accuracy the methods of analysis used for predicting the behavior of PWR vessels under thermal shock conditions. Analysis indicates that in present generation and future PWR vessels crack propagation will not occur as a result of thermal shock, but in older vessels it may. However, it appears that a phenomenon known as warm prestressing will prevent excessive crack penetration.

**21652** **LOFT emergency core-cooling system experiments: results from the L1-4 experiment.** Leach, L.P.; Ybarrondo, L.J. *Nucl. Saf.;* **19**: No. 1, 43-49(1978).

Results from emergency core-cooling system experiments in the Loss-of-Fluid Test facility are described. The experimental results are put in perspective by comparing them with results from the much smaller Semiscale facility and pretest predictions made with RELAP4/MOD5 computer code. Emphasis is placed on the most recent Loss-of-Fluid Test nonnuclear experiment, designated L1-4, in which the emergency core-cooling water was injected into the reactor inlet pipe, as it is in many commercial nuclear reactors. General system behavior during the decompression, emergency core-cooling water mixing phenomenon, and emergency core-cooling water bypass are evaluated.

**21653** **Review of safety-related occurrences in nuclear power plants as reported in 1976.** Scott, R.L.; Gallaher, R.B. *Nucl. Saf.;* **19**: No. 1, 80-90(1978).

The article reviews the "Reportable Occurrences" submitted in 1976 to the U.S. Nuclear Regulatory Commission concerning light-water-reactor nuclear power plants. The review covers 1253 reports from boiling-water-reactor facilities and 1264 reports from pressurized-water-reactor facilities. Information is presented in tables listing instrument failures, equipment failures, systems involved, causes, deficiencies and times of occurrence (i.e., refueling, testing, operation, or construction.) The tables give the number of reports concerned which each listed item and therefore indicate the frequencies of events and those events which should receive more attention in the form of maintenance and testing to improve plant reliability and safety.

**21654** **Reportable occurrences at nuclear reactors and their causes.** Scott, R.L.; Gallaher, R.B. (comps.). *Nucl. Saf.;* **19**: No. 1, 100-108(1978).

Reports on reportable occurrences at nuclear reactors are submitted to the Nuclear Regulatory Commission (NRC), and these reports are accessioned and reviewed by the Nuclear Safety Information Center at Oak Ridge National Laboratory. A list of reportable occurrences during September and October 1977 which involved reactor shutdowns is presented. Included in the list are occurrences at operating research reactors and commercial power reactors. Only those occurrences involving reactor shutdowns are listed.

**21655** **Availability and safety of nuclear power stations.** Garaud, J. (Electr de Fr, Therm Prod Lab). *Mater. Tech.;* **65**: No. 6, 305-310(Jun 1977). (In French).

Ways of reducing the radiation dose rate and the exposure time to which plant personnel are subjected during maintenance operations performed on pressurized water reactors are indicated, including the elimination of radioactive corrosion products from the primary fluid by treatment with ion-exchange resins, decontamination of the circuits before conducting maintenance operations, surface treatments to control the rate of release of corrosion products and adherence of the deposits, and the replacement of materials giving rise to the formation of radioactive cobalt isotopes by materials with lower cobalt content.

**21656** **Evaluation of effects of finite mixing time and non-condensable gas on fuel—sodium interactions.** Saito, S. (Jpn At Energy Res Inst, Tokai-mura, Ibaraki-ken). *J. Nucl. Sci. Technol. (Tokyo);* **14**: No. 6, 395-406(Jun 1977).

An approach has been tried to provide more realistic estimates of pressure history and mechanical work caused by fuel-sodium interaction (FSI) in postulated fast reactor accident. The work reported here is focussed on the evaluation of the effects due to fragmentation process or finite mixing time and presence of non-condensable gas on FSI. 6 refs.

**21657** **Nuclear safety problems and their consequences for the materials used.** Servant, J. (Interministe Common on Nucl Regul, Fr). *Mater. Tech.;* **65**: No. 6, 295-303(Jun 1977). (In French).

Major risks inherent in the nuclear industry are cited, including those due to the presence of large amounts of energy stored in the pressurized fluids and in the stressed or moving structures in each unit, problems in evacuating thermal energy after emergency shutdown, and problems in containing radioactive products during an emergency.

**21658** (JAPFNR—262) **Transient boiling of sodium in a 19-pin bundle under loss-of-flow conditions.** Kikuchi, Y.; Haga, K. (Power Reactor and Nuclear Fuel Development Corp., Oarai (Japan)). Jun 1977. Translation of PNC-N—943-77-04. (CONF-770640—3). 9p. Dep. NTIS (US Sales Only), PC A02/MF A01.

From 7. liquid metal boiling working group meeting; Petten, Netherlands (1 Jun 1977).

Work performed under United States—Japanese Fast Reactor Exchange Program.

Experimental studies were carried out on transient sodium boiling in an electrically heated 19-pin bundle under loss-of-flow conditions. In the first series of experiments temperature distributions in the bundle were measured under initial steady state non-boiling conditions. The measured temperature distributions agreed fairly well with the calculation by the computer code NORMAL. In the second series of experiments transient boiling phenomena were investigated under loss-of-flow conditions. No high superheat was observed for boiling initiation. The observed coolant voiding was initially limited to the center subchannel because of steep temperature gradient in the bundle and then spread slowly.

**21659** (K—76-124U(R)(Vol.2)) **Safety analysis of an HTGR plant including emergency shutdown. Appendix, Volume 2. Final report.** (Kaman Sciences Corp., Colorado Springs, Colo. (USA)). 30 Apr 1977. Contract EY-76-C-03-1148. 124p. Dep. NTIS, PC A06/MF A01.

A detailed description of HTGR Plant Shutdown and Emergency Cooling Equipment with simplified drawings is presented.

**21660** **Investigation of variation of the parameters of a medium in a pressurized space after loss of tightness in a high-pressure loop.** Gordon, B.G.; Mal'tsev, B.K.; Bogdan, S.N. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 62-65(Feb 1977). (In Russian).

Results of experiments on changes of parameters in a pressurized enclosed space, after a heat carrier penetrates into it, are set forth. The measurement apparatus is described and measurement errors are considered. Calculations of the processes involved are made by means of a program prepared earlier. The necessity of

taking into account heat exchange with the walls of the encloded space in question is pointed out.

**21661 Measurement techniques for AGR circulators in a full-density rig.** Watson, I.; Wilson, R.R. (James Howden and Co Ltd, Glasgow, Scotl). pp 65-79 of In Conference on the operation of instruments in adverse environments. London; Institute of Physics (1977).

From Conference on the operation of instruments in adverse environments; London, UK (4 Oct 1976).

See CONF-7610120—.

Safety and reliability of a nuclear power plant regarding the circulators used to drive the high-density $CO_2$ around the reactor core and boiler circuits are discussed. Under operating conditions, very high sound-pressure levels are generated which could excite components and cause possible fatigue failures. Failures of this type were experienced on the original axial blowers for the Hinkley 'A' Magnox reactor and, following this, a stringent test plan was specified for the AGR circulators. Techniques used to measure strain, sound and vibrations on circulators in a full-density rig are described. This rig reproduces the actual reactor working conditions of 300°C and 4.1 MN $m^{-2}$ with gas velocities up to 120 m $s^{-1}$. Under these conditions sound-pressure levels of up to 172 dB are generated. Some of the testing problems, together with the solutions found, are discussed.

**21662 Engineer-constructor's approach to reliability engineering in nuclear power plants.** Gallagher, J.G.; Hotchkiss, W.T. (Stone and Webster Engineering Corp., Boston). *Trans. Am. Nucl. Soc.;* **27**: 97-98(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21663 Integration of nuclear reactor safety in instructional programs at RPI.** Malaviya, B.K.; Ryan, R.M. (Rensselaer Polytechnic Inst., Troy, NY). *Trans. Am. Nucl. Soc.;* **27**: 107-108(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21664 Reactor safety education at Northwestern Univeristy.** Lewis, E.E. (Northwestern Univ., Evanston, IL). *Trans. Am. Nucl. Soc.;* **27**: 109-110(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21665 Reactor safety in the nucelar engineering program at UCLA.** Kastenberg, W.E. (Univ. of California, Los Angeles). *Trans. Am. Nucl. Soc.;* **27**: 110-111(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21666 Instruction related to reactor safety as offered by the MIT Nuclear Engineering Department.** Lanning, D.D. (Massachusetts Inst. of Tech., Cambridge). *Trans. Am. Nucl. Soc.;* **27**: 111-112(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21667 Pressure vessel question.** Karam, R.A. (Georgia Inst. of Tech., Atlanta). *Trans. Am. Nucl. Soc.;* **27**: 112-113(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21668 Nuclear reactor safety education at Purdue.** Theofanous, T.G.; Ott, K.O.; Sesonske, A. (Purdue Univ., West Lafayette, IN). *Trans. Am. Nucl. Soc.;* **27**: 113-115(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21669 Special considerations for seismically active areas.** Blume, J.A. (URS/John A. Blume and Associates, Engineers, San Francisco). *Trans. Am. Nucl. Soc.;* **27**: 155(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

# ENERGY STORAGE

*REFER ALSO TO CITATION(S) 22604*

**21670 Simulation algorithms and their realization by digital computer for calculation of wind- and solar-plant storage-service capacity.** Salieva, R.B. (Tashkent Electr Eng Inst for Commun, Uzb SSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 53-58(1977).

A method of calculating the capacity of storage devices is discused; the mathematical model is based on a statistical model. For digital-computer modeling, appropriate simulation algorithms have been written that make it possible to determine storage-device capacity, total throughput, disposal of idle unused output, energy deficit, and other characteristics.

## FLYWHEELS

*REFER ALSO TO CITATION(S) 21857, 21858*

## THERMAL

*REFER ALSO TO CITATION(S) 21321, 21326, 21331, 21384, 21746*

**21671** (AD-A—042389) **Material selection considerations for fluoride thermal energy storage containment in a sodium heat pipe environment. Final report 1 June—August 1976.** Jacobson, D.L. (Purdue Univ., Lafayette, Ind. (USA)). May 1977. Contract F33615-74-C-2014. 34p. NTIS PC A03/MF A01.

A literature survey to determine the state-of-the-art of materials in a high temperature Na and vacuum environment as applied to thermal energy storage was conducted. It was found that little information exists for materials or heat pipes in the high temperature (1400°K) Na or vacuum environments. Program recommendations are to perform life tests on candidate materials and Na heat pipes with post test corrosion analyses. Na wicking parameter must be determined experimentally for accurate heat pipe design.

**21672** (ORO/5217—1) **Macro-encapsulation of heat storage phase-change materials for use in residential buildings. First quarterly progress report, September 29—December 29, 1976.** Lane, G.A.; Kott, A.C.; Rossow, H.E. (Dow Chemical Co., Midland, Mich. (USA)). Feb 1977. Contract EY-76-C-05-5217. 56p. Dep. NTIS, PC A04/MF A01.

Objectives are to assess the feasibility of macro-encapsulated PCM's for residential solar systems, to develop and evaluate such materials. Five PCM's have been selected from encapsulation studies. Encapsulated storage media were evaluated theoretically in storage beds with air and water as the heat transfer medium. Cylindrical, tetrahedral, and pillow shapes are being evaluated for the encapsulated PCM. Encapsulant materials under consideration are multilayer flexible plastic films, steel cans, and plastic bottles.

## BATTERIES

### DESIGN AND DEVELOPMENT

**21673 Electrochemical cell.** Johnson, D.H.; Kubala, D.M.; Bennett, R.J. (to Union Carbide Corp.). German(FRG) Patent 2,629,028/A/. 13 Jan 1977. 27p. (In German).

The high energy densities of primary cells on the basis of lithium or sodium as anode material, liquid cathode materials and nonaqueous electrolytes could not previously be fully utilised, because volume changes appearing during the discharge process inside the cell lead to an increase of cell impedance. In order to overcome this disadvantage, according to the invention a tube consisting of carbon which is slotted in the longitudinal direction is used as the cathode current collector. It is elastic in the radial direction and exerts an even pressure in the beaker-shaped cell vessel on the separator and therefore on the anode material touching the inner wall of the vessel. In order to achieve the elastic deformability of the cathode current collector, acetylene soot is used, to which are added as described in the invention, elastomers and/or mixed polymers in quantities of 10 to 30% by weight. Further claims concern the use of at least one oxyhalide of an element of groups V or VI or a halide of an element of groups IV, V or VI of the periodic table in the cathode solution.

**21674 Towards long-lived satellites.** Casey, E.J. (Def Res Establ, Ottawa, Ont). *Can. Aeronaut. Space J.;* **23**: No. 5, 279-285(1977).

A survey is made of work done on satellite onboard energy-storage subsystems in support of the Canadian Space Program. In

particular, an assessment is made of the possible use of nickel/cadmium and nickel/hydrogen batteries for the period from now until 1985. The report considers what it would cost to marshal the capability and assure longevity of the battery in future Canadian operational satellites.

**21675 Electrochemical generator.** Jumel, Y.; Gabano, J.P. (to Societe des Accumulateurs Fixes et de Traction). German(FRG) Patent 2,545,498/A/. 29 Apr 1976. 15p. (In German).

Primary batteries with negative electrodes made of lithium or sodium, electrolytes other than water and metal oxides as positive masses show a high discharge voltage at the start of discharge, which only settles at an even level after a certain discharge period. This property is a disadvantage for some applications. According to the invention a starting discharge voltage near the level voltage is achieved if the electron conductor and the reduction product of the positive active mass has an over-voltage leading to the destruction of the solvent, compared to the solvent of the electrolyte (other than water), so that the destruction of the solvent takes place at a voltage which lies below the reduction voltage of the positive active mass during discharge.

### MATERIALS, COMPONENTS, AND AUXILIARIES

**21676 High temperature battery requirements put ceramics through their paces.** Birk, J.R. (Electr Power Res Inst, Palo Alto, Calif). *Insul./Circuits;* **23**: No. 10, 23-25(Sep 1977).

Ceramics are used in feedthroughs, separators (spacers), and, in the sodium/sulfur system, as an electrolyte. Problems of achieving energy and power density and thermodynamic stability are discussed.

## ENERGY MANAGEMENT AND POLICY

**21677** (BNL—50501-R) **Energetics of the United States of America: an atlas.** Drysdale, F.R.; Calef, C.E. (Brookhaven National Lab., Upton, N.Y. (USA)). Oct 1977. Contract EY-76-C-02-0016. 447p. Dep. NTIS, PC A19/MF A01.

In this update, a description of the United States' energy system is presented in the form of thirty-one maps and eight major tables. The county has been chosen as the basic unit for reporting estimations of many energy, demographic and economic variables. The variables include production of all fuels (including hydroelectricity), uses of fuels and electricity broken down by sector and end-use, existing and planned electricity generation capacity, refinery capacities, and emissions of air pollutants from fuel use. Calculations and assumptions used to make county level energy estimates are described in detail. The original atlas (BNL-50501) was cited in Energy Abstracts for Policy Analysis, 3:2052.

**21678** (CONF-7706101—) **Education confronts the energy dilemma.** (Council for Educational Development and Research, Washington, D.C. (USA)). 1977. Contract EX-77-G-01-6006;EX-76-X-10-5377. 280p. Dep. NTIS, PC A13/MF A01.

From 6. annual conference council for educational development and research; Washington, DC, USA (22 Jun 1977).

The conference was convened to present a role that America's schools could play in solving or coping with the energy crisis. Eleven sessions were conducted to fulfill this concern: Our Energy Crisis and Education: A Critical Assessment; The Energy Agenda at the Office of Education; Energy Resources: Scenarios for the Future; The Moral Dilemma of Energy Education; Constraints Influencing Education's Role; Energy Education: What's Been Done to Date; Practitioners Discuss Their Future Roles, Responsibilities; Politics of Energy Education; Confronting the Energy Dilemma; The Meaning of Scarcity; and The Impact of the Carter Energy Program on American Schools. Summary reports and reactions to the conference conclude the proceedings. (MCW)

## ENERGY ANALYSIS AND MODELING

*REFER ALSO TO CITATION(S) 21690, 21718, 21719, 21739, 21740*

**21679** (BNL—22677) **Energy information and analytic system for New York State.** Carroll, T.O.; Allentuck, J.; Goldberg, M.D.; Nathans, R.; Palmedo, P.F.; Pouder, R.; Svei, D. (Brookhaven National Lab., Upton, N.Y. (USA); State Univ. of New York, Stony Brook (USA). Inst. for Energy Research). 9 Aug 1976. Contract EY-76-C-02-0016. 98p. Dep. NTIS, PC A05/MF A01.

This review of energy information needs and activities in the State of New York and in 20 other states provides background for the types of policy issues and data critical to the design of an energy information/analytic system. The basic conceptual framework employed in the design is similar to that of the regional versions of the Brookhaven Reference Energy System. This framework is similar to that used in many state systems, for example, in proposed systems for the states of Nebraska and New Jersey and in existing systems in Maryland, Wisconsin, California, and New England. This framework is sufficiently general to permit the examination of a wide range of state energy policy issues and will provide an integrated picture of the state's energy supply-distribution-demand system which can be utilized by technical staff and policy makers to gain insight into the complex interaction between economic, technological, social, and environmental factors. The system is structured as a set of four basic elements--a broad base of state-specific data and information, a computerized retrieval system with easy terminal access to national data bases, adaptation of useful analytical models, and a modular construction which will allow sequential development of full capabilities of the total system. Finally, an action plan describes the sequence of tasks and costs required to implement a working system. This action plan serves to establish a base of data and report capability to deliver to decision makers a comprehensive overview of the state energy system, disaggregated fuel flows to specific end use sectors, flows to geographic regions in the state, trends in energy supply and consumption patterns, and other basic energy information.

**21680** (HCP/M3879—1(Vol.2)) **Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II.** (Resource Planning Associates, Inc., Washington, D.C. (USA)). 14 Oct 1977. Contract EX-76-C-10-3879. 336p. Dep. NTIS, PC A15/MF A01.

Two phases of the study preceded the development and testing of a general approach to managing rapid energy-supply-related community development. In the first phase, the problems arising in the rapid-growth process were identified and in the second, U.S. and European solutions were identified that would solve these problems. Several analytical outputs that shaped the general approach and its adaptation to the selected target community (Mercer County, North Dakota) were produced. In this volume, twelve appendices are given. These include methodologies of the development of analytical tools and investigation of community-development approaches and the selection of communities; profiles of incipient U.S. and previous U.S. boomtowns and European Communities; inapplicable U.S. approaches; Wyoming and North Dakota joint powers legislation; inapplicable European community-development approaches; methodology: testing the feasibility of the general approach; and quantification of Mercer County fiscal requirements. The final 2 appendices compile data on personnel and an extensive bibliography. (MCW)

## ECONOMICS AND SOCIOLOGY

*REFER ALSO TO CITATION(S) 21416, 21430, 21680, 21713, 21719, 21722, 21747*

**21681** (HCP/M3879—1(Vol.1)) **Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume I.** (Resource Planning Associates, Inc., Washington, D.C. (USA)). 14 Oct 1977. Contract EX-76-C-10-3879. 140p. Dep. NTIS, PC A07/MF A01.

To achieve the objectives of ERDA's Community Systems Program, physical and institutional characteristics that determine a community's levels and patterns of energy use must be defined and methods of coordinating its energy systems established. In Chapter 1, Managing Rapid Growth to Achieve the Goals of Energy-Related Community Development, the goals are identified and the development activities and management functions constituting an effective approach to achieving them are defined. The characteristic problems of rapid growth are described and their causes traced. In Chapter 2, Identifying Elements of a Community-Development Approach Applicable to the Rapid-Growth Context, a number of domestic and European community-development approaches that might be applicable to managing rapid growth in the boomtown context are surveyed. Applicable elements of a number of U.S. mechanisms and of two French community-development approaches that can serve as the basis for formulating an organizational approach are identified. In Chapter 3, Formulating a General Community-Development Approach, the effectiveness of the approach, its adaptability to the boomtown context, and its capability for achieving the goals of energy-related development are demonstrated. In Chapter 4, Adapting the General Approach to Mercer County, North Dakota, the complex rapid-growth situation in Mercer County, North Dakota, is described. Chapter 5 is entitled, Defining the Limitations of the Mercer County Approach and the General Approach. The content of Volume I is supplemented and supported by a series of appendixes, assembled in Volume II. (MCW)

**21682** (HCP/M3879—0003) **Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Executive summary.** (Resource Planning Associates, Inc., Washington, D.C. (USA)). Dec 1977. Contract EX-76-C-10-3879. 36p. Dep. NTIS, PC A03/MF A01.

This executive summary highlights and condenses the report HCP/M-3879/1, Vol. 1, which analyzes the community-development process and formulates an organizational approach to resolving the institutional and financial issues arising from energy-related community development.

**21683** (PB—269497) **Information and data flows in societal problem areas: focus—energy. Final report.** Freeman, J.E.; Kottenstette, J.P.; Gatseos, P.M. (Denver Research Inst., Colo. (USA)). May 1977. 68p. (KNUTAP—5211-01-FR). NTIS PC A04/MF A01.

This report addresses the problem of how scientific and technical information and data (STID) flow from research into decision making in efforts to solve important societal problems. Two case studies of STID flows in the area of energy provide an empirical base for the report. Chapter 1 presents orientation and definitions. Chapter 2 examines how three emerging social values—energy sufficiency, environmental protection, and citizen participation--are increasingly shaping energy decision making in the U.S. A typology of energy STID flows is presented in Chapter 3, along with a set of 8 key questions that administrators can use to determine the adequacy of information-transfer arrangements supporting energy problem-solving. Case-study results are presented in Chapters 4 and 5 as answers to the 8 key questions. No significant deficiencies were found in the scientific and technical information systems and services (STI/SSs) used by persons in the cases examined, although some opportunities for improving STI/SS contributions to future energy problem-solving activities are presented. Chapter 6 summarizes the major lessons learned and a brief argument for viewing STID flows in societal problem areas from a 'knowledge utilization' perspective.

**21684** (PB—271104) **Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report.** Job, C.A.; Bohne, R.M.; Clemens, R.H.; Gross, T.; Hall, J.R. (Great Lakes Basin Commission, Ann Arbor, Mich. (USA)). 14 Jan 1977. 527p. NTIS PC A23/MF A01.

The study examined the state and Federal roles in energy facility siting in order to develop institutional and technical policy options which the Great Lakes states might employ to influence or control energy facility siting, primarily in their coastal zones. Coal-fired and nuclear power plants, fuel (coal and oil) transshipment and storage facilities, and refineries were described generally and their resource requirements examined. These resource requirements were then applied to four regional electrical energy facility scenarios to establish land, water, and fuel (coal) requirements for the period 1975-1995 for a range of annual electrical energy consumption growth rates from 3% to 8% for each of the Great Lakes states and their respective tier of counties bordering the Great Lakes.

**21685** (TID—28070) **Archaeological and historical investigations for energy facilities: a state of the art report.** Poirier, B.W. (Iroquois Research Inst., Fairfax, Va. (USA)). Feb 1977. 296p. Dep. NTIS, PC A13/MF A01.

Several Federal Power Commission authorized projects faced unforeseen expenditures involving sums of $100,000 to one million dollars for protection of archaeological and historical sites. Archaeological and historical sites are herein described by the collective term cultural resources. This report examines the background of Federal laws and regulations for cultural resource protection, describes the current practices in cultural resource surveys and impact mitigation methods, and analyzes current costs of surveys and mitigation alternatives. Knowledge of these current practices is valuable in the planning and execution of cultural resource investigations consistent with the requirements of the cultural resource preservation laws and sound engineering practice. Compliance measures protecting cultural resources are rooted in several laws: the Reservoir Salvage Act of 1960 (amended, 1974), the National Historic Preservation Act of 1966 (amended, 1976) and the National Environmental Policy Act of 1969. These laws, along with resultant regulations require the FPC to consider potential impacts on cultural resources in the licensing and certificating of projects. The Office of Archaeology and Historic Preservation in the National Park Service has primary responsibility for implementing these laws.

**21686** **OPEC special fund.** *OAPEC News Bull.;* **4**: No. 1, 17-20(Jan 1978).

Members of the Organization of Petroleum Exporting Countries established the OPEC Special Fund in 1976 to assist developing countries and promote the concept of a new international order based on global cooperation. A review is given of the fund's history, character, and its activities during the first year, when $435.5 million was authorized. Most member countries have contributed to the fund and there have been 49 beneficiaries, who must qualify on the basis of economic criteria. The interest-free loans must be used to import essential capital goods for agricultural and industrial use and for essential consumer goods.

**21687** **1977 guidebook to California taxes with special emphasis on relationship to Federal taxes.** Bock, R.S. . Chicago; Commerce Clearing House, Inc. (1977). 462p. .

This book is designed to be a quick reference work on California State taxes. With this in mind, the amount of detail is kept to a minimum by assuming that the reader has some knowledge of Federal taxes that are generally similar to the major California taxes (or that he has access to the wealth of information about Federal taxes that is readily available). The book explains the four major California taxes (personal income tax, tax on corporate income, inheritance tax, and gift tax), whenever possible, in terms of the comparable Federal taxes. Differences between the two laws are pointed out, and cross-references make it possible to trace from a given provision in one law to a comparable provision in the other. Special attention is given to subjects peculiar to the California law. In addition to the major State taxes, the book provides general information about other taxes levied by the State. Property taxes are also discussed briefly, because of their statewide impact, although they are imposed by local governmental units.

## ENVIRONMENT, HEALTH, AND SAFETY

*REFER ALSO TO CITATION(S) 21419, 21524, 21684, 21730, 22144, 22230*

**21688** (PB—269748) **Environmental protection issues facing the nation.** (General Accounting Office, Washington, D.C. (USA). Community and Economic Development Div.). 8 Jul 1977. 66p. (CED—77-92). NTIS PC A04/MF A01.

In recent years the need to protect human health and the environment from pollution has become clearly evident. The Federal Government has responded to this need by enacting far-reaching legislation which could cost an estimated half a trillion dollars over the next few decades. Questions have been raised on whether the environmental goals are achievable or whether the right balance has been struck between environmental objectives and energy, economic, and social goals. These questions must be answered if a viable environmental program is to be achieved. This study describes and identifies what are believed to be the major environmental issues facing the Congress and the Nation.

**21689** (PB—269875) **Program to pay black lung benefits to coal miners and their survivors: improvements are needed. Departments of Labor and Health, Education, and Welfare.** (General Accounting Office, Washington, D.C. (USA). Health Resources Div.). 11 Jul 1977. 86p. (HRD—77-77). NTIS PC A05/MF A01.

Report ot the Senate Committee on Human Resources.

Black lung, a chronic disease, has the medical designation coal workers' pneumoconiosis. The Congress, in enacting the Federal Coal Mine Health and Safety Act in 1969, intended to provide benefits to miners disabled by black lung and survivors of miners who died from the disease. However, the law's 3-year filing requirement has resulted in Labor having to deny many claims for living miners and widows who otherwise would be eligible, as shown in this report. Accordingly, if the Congress wishes to provide such claimants with an opportunity to qualify for benefits, it should again amend the act.

## ENERGY RESOURCES

*REFER ALSO TO CITATION(S) 21713, 21717, 21745*

**21690** (CONF-761061—) **XIV APCOM symposium, preprints.** (Pennsylvania State Univ., University Park (USA)). 1976. vp. State Univ., University Park.

From 14. international symposium for the application for computers and mathematics in the mineral industries; University Park, PA, USA (4 Oct 1976).

Seventy-eight preprints are included from the symposium. One paper had previously been cited. The following session titles and number of papers announced are: National Planning for Minerals (6 papers); Case Studies in Mining (5 papers); Mineral Processing (6 papers); Exploration and Ore Reserves, (6 papers); Information Systems for Mine Planning (5 papers); Environmental Planning for Underground Mining (6 papers); Production Planning (5 papers); Systems Models in the Mineral Industry (6 papers); Production Planning (6 papers); Pattern Recognition with Earth Data (4 papers); Financial Analysis (6 papers); Geostatistics (5 papers); Investment Decision Making (6 papers); Natural Resource Modeling (6 papers). (MCW)

**21691** (PB—269451) **Bush Dome model computing movement of injected crude helium. General instruction manual for computer program KWDX-577-mp for computing gas movement in a gas storage reservoir. Final report.** Eilerts, C.K. (Environmental Protection Agency, Dallas, Tex. (USA). Region VI). Jun 1977. 210p. (BM-Taps—4-77(KWDX-577-MP)). NTIS PC A10/MF A01.

Conservation helium, stored in Bush Dome Reservoir as crude helium containing a mixture of approximately 70 percent helium and 30 percent nitrogen, displaces natural gas under pressure. A computing program was developed to simulate the movement of the crude helium that includes the effects of variations in the pressure-dependent gas properties of as many as three distinct gases, and the effects of variations in reservoir structure thickness, permeability, and porosity. The equations that represent two-dimensional transient flow of gases in a porous medium have been applied to test a 25-year crude helium storage plan. Results indicate that the crude helium can be maintained in a compact mass and that, by controlling the flow rates of injection and withdrawal wells, it can be efficiently recovered.

**21692** (PB—269803) **Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress.** (General Accounting Office, Washington, D.C. (USA). Community and Economic Development Div.). 5 Jul 1977. 38p. (CED—77-88). NTIS PC A03/MF A01.

This report describes management actions needed to minimize damage to the Nation's vast public rangelands. These lands have been deteriorating for years and, for the most part, are not improving. Deterioration can be attributed principally to poorly managed grazing by livestock--horses, cattle, sheep, and goats. Livestock have been permitted to graze on public rangelands year after year without adequate regard to the detrimental effect on range vegetation. Authority to graze livestock on public rangeland is granted to operators by Federal permits, licenses, or leases issued for periods of 1 to 10 years.

**21693 World Energy Conference reveals Soviet energy strategy.** Jenkins, N. *Energy Int.;* **15**: No. 1, 17-20(Jan 1978).

The Soviet Union's eight presentations at the 1977 World Energy Conference exceeded the contributions of other participants and demonstrated the country's potential for future energy self-sufficiency and industrial expansion based on internal resources. The USSR is the leading producer of oil and natural gas and expects to produce 640 million tons of oil and 435 billion cubic meters of gas in 1980. New techniques, such as block flooding and cluster drilling, were described. Large coal deposits in the Kansk-Achinsk area present economic problems because of the long distances involved. Combined heat and power facilities are being planned for the area. Conservation was emphasized in papers describing programs to reduce industrial demand. A survey of Soviet nuclear programs indicates a familiar conflict between continued use of fossil fuels and the need to develop nuclear fuels. Energy policies indicate a future dependence on nuclear fuels for heat and electricity. Work on fusion energy stresses confinement and plasma research.

**21694 Defining upper limits to groundwater development in the arid West.** Burt, O.R. (Montana State Univ., Bozeman); Cummings, R.G.; McFarland, J.W. *Am. J. Agric. Econ.;* **59**: No. 5, 943-947(Dec 1977).

Water scarcity imposes severe constraints on industrial development in the Rocky Mountain region, where new water can only be obtained by reallocating supplies from agricultural use or by exploiting ground water stocks. These stocks have already been seriously depleted in recent years because of rapid mining and demonstrate the need to develop an optimal steady-state level for ground water stocks in which the natural recharge rate will determine the pace of water withdrawal for development activities. A methodology is described for determining optimal steady-state levels and is applied to the Estancia Valley in New Mexico. Socio-economic, legal and political factors as well as hydrologic and geologic information are included in the model. 9 references.

**21695 Energy resources available to man.** Curran, S. (Univ of Strathclyde, Glasgow, Scotl). *Phys. Technol.;* **8**: No. 4, 138-143(Jul 1977).

Potential options and dilemmas in harnessing the world's energy resources are appraised.

**21696 Global problems and energy.** Kapitza, P.L. (Institute for Physical Problems, Academy of Sciences of the USSR). *Sov. Phys. - Usp. (Engl. Transl.);* **20**: No. 6, 547-553(Jun 1977).

During the present century, due to an increase in the number of people on the earth and to a growth of material culture, technological and energetic processes have begun to take place which have started to alter the nature of the whole globe. Some of these changes have become so significant as to constitute a danger for the safe existence of humanity as a whole. In this paper it is shown that global problems usually develop according to exponential laws when an acceleration of the processes acquires the character of an explosion. The solution of global problems consists of bringing them under control and preventing an explosion. One of the problems is associated with the depletion of energy resources which are a basic factor determining the level of contemporary civilization. It is shown that the only way to escape the crisis consists of making a transition to atomic energy. An examination is made of the technical, scientific and social difficulties which lie in the path to this solution and which it is necessary to resolve.

**21697 Bureau of Mines research 1976: a summary of significant results in mining, metallurgy, and mineral economics.** Washington, DC; Department of the Interior (1976). 154p. (NP—22764).

It takes 40,000 pounds of mineral commodities such as stone, coal, metals, petroleum, and natural gas to sustain each person annually in the U.S. Although these basic materials constitute a relatively small fraction of the total GNP, the energy-generating and material-processing industries apply labor, capital, technology, and enterprise to multiply their value about three times. Through research, the Bureau of Mines improves technology to increae recovery of coal, copper, and other minerals from domestic deposits; improve the economics of recycling scrap metals; extend the normal lifespan of virgin metals and materials; and find industrial uses for mineral-processing wastes. This sixth in a series of annual Bureau of Mines publications, Research 76, highlights significant research projects and mineral data studies conducted in the past fiscal year. In-house investigations at research facilities throughout the United States utilized approximately $69 million of the Bureau's $159 million budget. During Fiscal Year 1976, Bureau R and D concentrated on increasing mineral production, decreasing energy usage through more efficient processing, and decreasing material losses caused by corrosion. Research continued on improving coal-preparation techniques, especially to expand utilization of low-grade coals and coals difficult to beneficiate. Because of fluctuations in the availability of foreign sources of raw materials (owing to varying international political and economic factors), the Bureau has intensified investigation into coal mining, uranium-ore processing, and geothermal energy sources—three alternatives for minimizing U.S. dependence on foreign energy sources. (MCW)

## RESEARCH AND DEVELOPMENT

*REFER ALSO TO CITATION(S) 21388, 21697, 21724*

**21698 Energy policy and research: discussion from the USDA perspective.** McCracken, R.J. (Dept. of Agriculture, Washington, DC). *Am. J. Agric. Econ.;* **59**: No. 5, 1087-1088(Dec 1977).

The U.S. Department of Agriculture (USDA) has had funding difficulties because its energy research requires a longer research period compared with ERDA's orientation to rapid development and commercialization. Not enough money has come from ERDA to support the traditional method of research done by USDA, whose general research funds are committed to other priority programs. The USDA and state agricultural experiment station (SAES) need continuity in their funding if they are to follow up new technologies by modifying present systems or developing new systems for the food industry. Although the problem may soon be resolved, it is important to develop faster ways of applying new technologies and to improve interagency responses to priority needs. Several priority items are suggested.

**21699 Energy policy and research: discussion from the ERDA perspective.** Clark, S.J. (Energy Research and Development Administration, Washington, DC). *Am. J. Agric. Econ.;* **59**: No. 5, 1089-1090(Dec 1977).

If the National Energy Plan is to be achieved, the agricultural sector must contribute by increasing energy use efficiency and must make this its top priority. Systems analysis, including water use, should be applied to the food and fiber industry rather than a fragmented approach to individual problems. ERDA's review and funding system is briefly outlined, and it is pointed out that research emphasis is placed on those areas in which energy costs are a significant part of total production costs.

**21700 Energy policy and research: discussion from a land-grant-institution perspective.** Fortmann, H.R. (Pennsylvania State Univ., University Park). *Am. J. Agric. Econ.;* **59**: No. 5, 1091-1092(Dec 1977).

The importance of adequate energy supplies for the agricultural sector is reaffirmed, and the cooperative intersectoral effort this will require is outlined. Because existing research systems will either be aided or hampered by the rules and regulations of the bureaucracy, efforts to promote cooperation and joint planning are endorsed as a way to expedite publicly funded agricultural research. The author points out that, although plans and recommendations are important, the land grand scientists are the ones who must ultimately solve the problems.

## NUCLEAR ENERGY

*REFER ALSO TO CITATION(S) 21184, 21185, 21186, 21187, 21188, 21193, 21595, 21596, 21600*

**21701** (PB—269745) **Cleaning up the remains of nuclear facilities--a multibillion dollar problem: Energy Research and Development Administration. Nuclear Regulatory Commission. Report to the Congress.** (General Accounting Office, Washington, D.C. (USA). Energy and Minerals Div.). 16 Jun 1977. 42p. (EMD—77-46). NTIS PC A03/MF A01.

The problem of protecting the public from the hazards of radiation, lingering at nuclear facilities which are no longer operating, needs Federal attention if a strategy for finding a solution is to be developed. The solution doubtless will be expensive--but the expense should be known so the responsible parties can plan for the inevitable cost. A strategy to clean up these privately and federally owned nuclear facilities, which continue to accumulate, cannot be developed until basic questions on the magnitude of the problem, such as costs, radioactivity, and timing, have been answered.

**21702** **Nuclear energy: nasty or necessary.** *West. Miner;* **50**: No. 8, 25, 27-28, 30-31(Aug 1977).

Canada has developed the successful CANDU reactor (Canada Deuterium Uranium) fueled by natural uranium and moderated (i.e., the nuclear fission rate controlled to required levels) by deuterium oxide, or 'heavy water'. There could be an installed capacity of about 14,500 MWe from nuclear plants in Canada by 1988. A survey of Canadian utility companies by AECL indicated that there existed estimates for a total nuclear capacity of about 25,000 MWe by 1990.

**21703** **Simulation of the nuclear power economy.** Triplett, M.B. (Battelle Mem Inst Columbus Lab, Ohio). *Nucl. Technol.;* **35**: No. 1, 162-172(1977).

Evaluation of nuclear power development policies requires the ability to forecast the economic and resource impacts attributable to a given policy. A computer simulation has been used in several recent evaluations of alternate nuclear-power-growth scenarios for the U.S. By using a discrete-event modeling approach, a flexible tool has been developed that can simulate most planned reactor systems in terms of their overall economics and their impacts upon fuel-cycle industries.

**21704** (CONF-770971—1) **Contribution to the general discussion by delegate from France.** Goldschmidt, B. 1977. Translation: source information not available. 6p. Dep. NTIS, PC A02/MF A01.

From 21. general conference of the International Atomic Energy Agency; Vienna, Austria (26 Sep 1977).

Mr. Goldschmidt, delegate from France, in his presentation announced that France means to contribute and help other countries in the global search for substitute fuels for oil, even those that must resort to nuclear energy. He lists the challenges that 1977 produced regarding world nuclear energy development. These challenges, he says, "produce a climate of instability in the industrial nuclear programs and mutual distrust between supplying countries and customer countries." The French government places its trust in the Secretariat of the International Atomic Energy Agency, he concludes. (MCW)

## TRANSPORT AND STORAGE

*REFER ALSO TO CITATION(S) 21746*

## WASTE HEAT UTILIZATION

*REFER ALSO TO CITATION(S) 21323, 21324, 21325*

**21705** (PB—269517) **HUD Utilities Demonstration Series. Volume 7. Performance analysis of the Jersey City total energy sits. Interim report.** Hebrank, J.; Hurley, C.W.; Ryan, J.D.; Obright, W.; Rippey, W. (National Bureau of Standards, Washington, D.C. (USA). Center for Building Technology). Jul 1977. 176p. (NBSIR—77-1243). NTIS PC A09/MF A01.

The National Bureau of Standards (NBS) has gathered engineering and economic data from an operating diesel total energy plant which supplies all electrical power, hot water, and chilled water to a 485-unit apartment/commercial building complex in Jersey City, New Jersey. Engineering data have been continuously collected since April 1975 by a data acquisition system (DAS) which monitors approximately 200 sensors located in the plant and site buildings. In this report, data for a one-year period from November 1975 through October 1976 are presented. Electrical and thermal demands by the site and plant equipment efficiencies have been determined from the data and are reported. Reliability data are also reported. Relative fuel savings by the total energy plant have been determined from the engineering data. Economic data describing the capital, operating, owning, and maintenance costs during the one-year period are also presented. Unit costs of electrical, heating, and cooling energy commodities are determined and compared to conventionally supplied energy unit costs.

**21706** **Fernheizungen. (Long-distance heating systems).** Homonnay, G. Karlsruhe, Germany, F.R.; C.F. Mueller (1977). 229p. (In German).

Following a survey on the history and development, causes and limits of the expansion as well as grouping of long-distance heating, the fundamentals of long-distance heating are outlined. The production of heat in connection with electricity generation and by heating plants is dealth with first, as well as the linking of heating plants and heat power plants, nonconventional, natural heat sources. The section on heat transport deals with the development of the hot-water long-distance heating and the construction of steam long-distance heating, as well as components, calculation and arrangement of long-distance heating systems. The problem of the hot-water consumer in connection with long-distance heating is limited to heating centres connected to hot-water and steam long-distance pieplines. Control and measurement problems of the heat carrier and an outline of the system characteristics of long-distance heating conclude this exemplary text book. 200 figs., 100 refs.

**21707** **Development of a total energy system for the Cedar Gap Christian Retreat Center.** Williams, J.R. (Georgia Inst. of Tech., Atlanta); Christianson, F.; Hudson, W.T. pp 38.27 of In Proceedings of the 1977 annual meeting of the American Section of the International Solar Energy Society. Volume 1, Sections 26—38. Beach, C.; Fordyce, E. (eds.). Cape Canaveral, FL; International Solar Energy Society (1977).

From Solar world meeting; Orlando, FL, USA (6 Jun 1977). See CONF-770603—P3.

The Cedar Gap Christian Center includes 2 lodges of 25 rooms each, a 5,300 sq. ft. dining hall, 6 cottages of 1,200 sq. ft. each, 6 cottages of 800 sq. ft. each, a shower and laundry facility of about 800 sq. ft., a 5,500 sq. ft. recreational building, and a 1,200 sq. ft. chapel. The decision was made to provide all the energy needs of the Christian retreat with on-site renewable sources of energy. The average electric power requirements of the retreat are projected to be around 35 KW with peak power requirements in excess of 100 KW. Much of this power will be provided by hydroelectric units on streams running across the property. The remainder will be supplied by wind generators and a solar power plant operated by excess heat from the solar collectors on the lodges and dining hall. As a final backup, a wood burning boiler in the substation at the lodge and dining hall can supply additional hot water for this facility as well as hot water to run the turbine-generator.

## CONSERVATION

*REFER ALSO TO CITATION(S) 21779, 21783, 21803*

**21708** (IMMR—24-M3-76) **Selected papers from a conference entitled "Focusing on Energy".** (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). Dec 1976. 31p. (CONF-760159—). for Mining and Minerals Research, Lexington, KY.

From Conference on focusing on energy; Lexington, KY, USA (22 Jan 1976).

This report was published as part of a program under the auspices of the Kentucky Center for Energy Research. Six papers in the report include: Design with Climate, Ralph Knowles; ERDA Program for Solar Heating and Cooling of Buildings, Walter Preysnar; Physical Plant Maintenance and Operations at The University of Minnesota, Donald Holberg; More Insulation Can Increase Energy Consumption, Computer Energy Analysis for Existing Buildings, and Exploding Some Myths About Building Energy Use, by Lawrence G. Spielvogel. (MCW)

**21709** (TID—28047) **Home energy savers program: a little time can save a lot of money.** Jensen, G.F. (Utah Engineering Experiment Station, Salt Lake City (USA)). Jun 1977. 414p. NTIS, MF A01.

A report on a demonstration project undertaken in Utah. Portions of document are illegible.

This is a report on an FEA-funded demonstration project in Utah designed to test a Home Energy Savers' Program. The basic purposes are: to encourage and bring about a significant reduction in energy use in homes and to test the impact of various energy conservation research elements on homeowners' participation. The principal research elements were: the direct mailing of workbooks to single-family homeowners, and the use of the telephone hotline workshops, a coordinated media program, and church and community support. The impact of a contest drawing designed to motivate

homeowners to compute their potential annual energy savings was tested.

**21710 Energy management seminar.** Seattle; Seattle City Light (Sep 1977). 105p. (NP—22827).

This Energy Management Seminar was conducted by Seattle City Light to assist its customers in making the most efficient use of energy resources available in the area. Practical information to effect immediate savings of 30% or more on utility and fuel bills by improving energy-use efficiency in the Seattle area is given. In addition to those immediate savings, long-term objectives established in an Energy Management Program, often requiring significant technical and engineering changes, are broadly discussed. Seattle City Light has pioneered more-efficient housing standards for a number of years. In 1973 Seattle City Light began its Kilowatt Program, and more recently has engaged in a number of advanced projects, including a sophisticated heat-recovery system for its own office building and Project Weathervane, an experimental solar and wind-powered house. These programs have saved money for the citizens of Seattle in a number of ways, both on the individual bills and through long-term reductions in energy requirements necessitating major new energy sources. (MCW)

**21711 Evolution of energy resources and their utilization: role of heat.** Angelini, A.M. (Ente Naz per l'Energ Elettr, Milan, Italy). *Termotecnica (Milan);* **31**: No. 8, 384-407(Aug 1977). (In Italian).

A general survey is given of world energy resources, their utilization by continents or large areas, and in particular the part played by heat. Problems of unequal geographic distribution of resources, possible future evolution and availability of resources, energy conservation and energy conversion are considered. In particular, increased application of the heat pump is recommended.

**21712 Proposed program for energy conservation in Utah.** Salt Lake City; State Energy Office (1977). 147p. (NP—22761).

The motivation behind Utah's three major operational goals--(1) public awareness, (2) achievement of a 5% or more reduction in the state's annual consumption, and (3) assisting other state jurisdictions to develop appropriate roles in the state conservation plan--are discussed. Long- and short-term objectives are identified. Projected energy savings from planned programs are discussed in the following programs: industrial conservation, transportation, thermal and lighting efficiency in buildings, state operations program, and agriculture. An educational and informational program will also yield an energy saving. (MCW)

## SUPPLY, DEMAND, AND FORECASTING

*REFER ALSO TO CITATION(S) 21693, 21723, 21745, 21750, 21813, 21814, 21815*

**21713** (AECL—5816) **Sources, availability and cost of future energy.** Hart, R.G. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Aug 1977. 33p. Energy of Canada Ltd., Pinawa, Manitoba, Canada.

An attempt is made to put the future Canadian energy scene in perspective by quantitatively examining energy resources, energy utilization, and energy costs. Available data on resources show that conventional oil and gas are in short supply and that alternative energy sources are going to have to replace oil and gas in the not-too-distant future. Cost/applications assessments indicate that a mix of energy sources are likely to best meet energy needs of the future. Hydro, nuclear, and coal are all practical alternatives for space heating. Coal appears to be the most practical alternative for meeting much of the industrial energy need, and frontier oil or oil from the tar sands appear to be the most practical alternatives for meeting the transportation need. Solar energy shows promise of meeting some of the space heating load in Canada if economical energy storage systems can be developed. The general conclusion is that the basic energy problem is energy conversion. 22 refs.

**21714** (DOE/ERA—0031) **Energy emergency planning guide: Winter 1977-78.** (Department of Energy, Washington, D.C. (USA). Economic Regulatory Administration). Nov 1977. 177p. Dep. NTIS, PC A09/MF A01.

Portions of document are illegible.

This Energy Emergency Planning Guide for Winter, 1977-78 has been prepared in order to: identify and evaluate actions available to deal with energy emergencies this winter; provide an advance indication to the public of those actions considered most likely to be taken by the government, and provide industry, state, and local governments with suggestions about actions which they can take to deal with energy emergencies. The Guide contains specifications for over 50 standby programs and procedures, recommended implementation guidelines for using these programs keyed to a pre-emergency phase and three phases of shortfalls, and a design for an Energy Emergency Center. Flexible implementation guidelines are proposed for natural gas, petroleum, electricity/coal, and propane shortages. (MCW)

**21715** (PB—268850) **Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide.** MacRae, E.C. (Federal Energy Administration, Washington, D.C. (USA)). Jun 1977. 72p. (FEA/N—77/115).

The Project Independence Evaluation System (PIES) provides the Federal Energy Administration's major mid-to long-term energy forecasting and analysis capability. It consists of a number of complex interrelated computer models and associated data bases which can be used to project the state of the energy market in the years 1980, 1985, and 1990. By varying assumptions and data, the user can define alternative scenarios for the analysis of alternative energy issues. The purpose of this document is to provide a potential PIES user with a description of how PIES operates with particular emphasis on the possible variations in assumptions and data that can be made in specifying alternative scenarios.

**21716 Agriculture and energy use in the year 2000: discussion of technological changes.** VanArsdall, R.T. (Dept. of Agriculture, Washington, DC). *Am. J. Agric. Econ.;* **59**: No. 5, 1071-1072(Dec 1977).

A forecast of continued heavy dependence on energy by all sectors of the food industry concludes that energy users, who must believe an energy problem exists before they will take action, will not resist economic pressures to change consumption habits as much as they will resist the structural changes caused by new energy technologies. To allow for the long lead time for new development and to avoid major disruptions when economics justifies change, energy policies are needed to support research, development, demonstration, and incentive programs in alternative energy supplies. Biomass is suggested as an area in which research to improve photosynthetic efficiency could provide an economically feasible system of agriculture in the future.

**21717 Agriculture and energy use in the year 2000: discussion from a natural resource perspective.** Barse, J.R. (Dept. of Agriculture, Washington, DC). *Am. J. Agric. Econ.;* **59**: No. 5, 1073-1074(Dec 1977).

Electricity development will have the greatest impact on the food sector, which accounts for a third of the power consumed in the U.S. Growth in power demand by 2000 will require two or three times the present coal production and will disturb 3 to 5 million acres of land. Although reclamation laws will restore much of the land, the distribution of disturbed land will be determined by which energy development policies are adopted. The social, economic, and resource effects of alternative policies on specific areas can be analyzed by locational impact modeling. Locational models can analyze the impact on water quality and underground hydrology as mining and power development compete against agricultural and aquatic activities. Teknekron, Inc. scenarios of air quality and emission controls indicate that stricter standards will be needed to accommodate an increase in coal-fired power plants.

**21718 Agricultural energy modeling for policy purposes.** Heady, E.O.; Dvoskin, D.D. (Iowa State Univ., Ames). *Am. J. Agric. Econ.;* **59**: No. 5, 1075-1078(Dec 1977).

Although the economic problems of rural areas are too broad to be modeled on a specific energy-related basis, the response of individual farms to energy prices can be analyzed and applied to broader economic policies. The use of alternative price scenarios to forecast substitute fuels, pump irrigation, and other investments under uncertainty can provide relevant information on the impacts of energy prices on all sectors of agriculture. Four problem areas (price uncertainty, commodity and food price increases, income level and distribution changes, and energy substitutions) are defined and analyzed with the national programming models of Dvoskin, Heady, and English. The model results include suggestions for new types of crops, new forms of agriculture, and adjusting land-use patterns to substitute land for energy.

**21719 Agricultural energy modeling: discussion of linear programming models.** Eidman, V.R. (Univ. of Minnesota, Minneapolis). *Am. J. Agric. Econ.;* **59**: No. 5, 1081-1082(Dec 1977).

A review of interregional programming techniques suggests several areas for improvement. A larger range of possible energy substitutes and available techniques needs to be incorporated into current aggregate models and analysis of crop production made at the farm level. A second area of concern is the need for more information on other embodied energy investments besides farm machinery since the total energy requirements of all machinery, equipment, and buildings will influence the choice of energy alternatives. Additional research is recommended for evaluating the effects of various energy-price scenarios on the choice of technology, the introduction of new technologies, and the adoption of policies to encourage energy efficiency through institutional adjustments.

**21720 Energy supply for the Federal Republic of Germany. Research and development for the energy supply.** Schmidt-Kuester, W.J.; Wagner, H.F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **30**: No. 7, 301-313(Jul 1977). (In German).

This survey deals with the problems and tasks of R and D for the future energy supply of the FRG. Individually dealt with are the strategy for planning the program energy research and technology, and the problems and potentials of new energy technologies. 7 figs., 8 tables

**21721 On strategies and fate.** Marchetti, C. (Institute for Applied Systems Analysis, Laxenburg, Austria). *Phys. Technol.;* **8**: No. 4, 157-162(Jul 1977).

Long-term planning for energy tends to be dominated by capital and resource availability. However, stronger constraints seem to be at work which greatly reduce the degree of freedom open to strategists. The author looks at some sensitive areas where efficient decisions can be taken, leading to very important long-term qualitative changes in the energy system.

**21722 On certain patterns in the development of the energy balance of the USSR.** Vigdorchik, A.G. *Power Eng.;* **14**: No. 5, 1-9(1976).

The significance of the consumption part of the energy balance in forming the proportions of the fuel-energy economy is considered; methods for estimating energy and fuel demand are characterized, and the structure of the expenditure of final-use energy and the participation of individual energy transport media principal energy-using processes are analyzed.

## POLICY, LEGISLATION, AND REGULATION

*REFER ALSO TO CITATION(S) 20936, 21035, 21415, 21419, 21420, 21421, 21422, 21423, 21688, 21689, 21698, 21699, 21700, 21715, 21729, 21731, 21732, 21733, 21736, 21748, 21783*

**21723 (FE/2660—1) Suggestions for a Phase-II national energy policy. Final report, March 1977—September 1977.** Brown, W.M.; Kahn, H. (Hudson Inst., Inc., Croton-on-Hudson, N.Y. (USA)). Sep 1977. Contract EF-77-C-01-2660. 236p. Dep. NTIS, PC A11/MF A01.

In order to obtain sufficient and secure long-term supplies of oil and gas at stable prices a number of suggestions are made for the next phase of the U.S. energy program. It is argued, first, that an expanding synthetic fuels program over a 20-year period is a feasible high-confidence way of reducing future fuel imports to an acceptable level, and that the required expenditures would be relatively small before the mid-'80s. Second, a large number of contingent energy developments are examined--including conservation--that are on the horizon; each of these is very promising but quite uncertain in its future impact. By 1985 the evaluation of these contingencies might well lead to a severe reduction or even cancellation of a further synfuels effort--a preferred outcome, but one not to be counted upon. Third, the Phase II U.S. Energy Program can also be designed with technical and political hedges to respond to either favorable or unfavorable developments; in particular, an energy mobilization base can be created to respond to various emergencies. New Federal policies would be desirable for an effective Phase-II program. The discussion emphasizes those relevant to (a) the early requirements for the proposed synfuels program, (b) the current domestic issues--particularly regulatory policy in the changing socio-political milieu, and (c) some international approaches involving cooperation with the IEA and other fuel-importing countries, and the potential for cooperation as well as confrontation with OPEC.

**21724 Energy policy and research in agriculture.** Gavett, E.E. (Dept. of Agriculture, Washington, DC). *Am. J. Agric. Econ.;* **59**: No. 5, 1083-1086(Dec 1977).

Basic goals of the proposed National Energy Plan (NEP) are outlined in terms of agricultural policies, which are aimed at providing enough food and fiber at reasonable prices. To reconcile the two sets of goals, agricultural and rural patterns must be changed. ERDA policies are shown to be oriented toward industry and large-scale technology, while the Department of Agriculture policies are based on retaining the family farm. Major issues center on the competition between food and coal production for land, water, labor, and community development. The NEP emphasis on solar energy, biomass, and other renewable energy sources also competes with agriculture for land. Agricultural economists are urged to participate in a national multidisciplinary research and development effort to resolve these issues. 9 references.

## FOSSIL FUELS

*REFER ALSO TO CITATION(S) 20841*

### COAL

*REFER ALSO TO CITATION(S) 20936, 21464, 21522, 21524, 21714, 21717*

**21725 (CONF-7606160—) Rocky Mountain Coal Mining Institute. 72nd regular meeting.** (Rocky Mountain Coal Mining Inst., Denver, Colo. (USA)). 1976. 77p. Mountain Coal Mining Inst., Denver.

From 72. regular meeting of the Rocky Mountain Coal Mining Institute; Vail, CO, USA (27 Jun 1976).

Papers presented at the Rocky Mountain Coal Mining Institute were: An Update on Federal Coal Policy; Coal Conversion Building Toward Commercial Development; Hydraulic Mining; Bureau of Mines Research Program to Improve Coal Mining Technology; Effect of Mining Productivity and Coal Washing on the Economics of Underground Coal Mining; Federal Black Lung Act: An Overview; May "We" Get "There" From "Here"; Practical Resin Anchor Anchor System for the American Mining Industry; Western Coal Development—Promise and Problems; General Design Considerations for Large Western Coal Handling Facilities; and Coal's Role in Future Energy Planning. A paper, My Forty-Nine Years with the Institute, by Fred W. Whiteside, is included and is a reprint. (MCW)

**21726 (FE—2343-45) Cash flow analysis of alternative approaches to commercialization of coal conversion technologies.** (Booz, Allen and Hamilton, Inc., Bethesda, Md. (USA). Booz, Allen Applied Research Div.). Sep 1977. Contract EX-76-C-01-2343. 53p. Dep. NTIS, PC A04/MF A01.

The economics of four alternative approaches to commercialization of coal conversion technologies are analyzed. Cash flows and internal rates of return are calculated for four assumed projects: (1) demonstration plant followed by commercial plant; (2) pioneer plant followed by commercial plant; (3) continued R and D followed by commercial plant; (4) commercial plant now. The sensitivities of the economic results to variations in the base case assumptions are tested to determine if changes occur in the relative desirability of the alternatives under different assumed conditions. The analysis shows that the economics for the four alternatives are close; consideration of risk and other nonfinancial issues will therefore be of major importance in deciding among the alternatives.

**21727 (TID—28066) Status of coal supply contracts for new electric generating units, 1976—1985.** Salkov, H.R.; Pyrdol, J.J.; Stewart, H.; Gakner, A. (Federal Power Commission, Washington, D.C. (USA). Bureau of Power). Jan 1977. 40p. Dep. NTIS, PC A03/MF A01.

During the 10-year period 1976 to 1985 the electric utility industry plans to install almost 111,600 megawatts of new coal-fired generating capacity. The majority of this new capacity will be sited west of the Mississippi River, with the largest coal expansion planned by utilities in the West South Central Region. Electric utilities project that by the end of 1985 new coal units planned for operation during the next 10 years will require about 358 million tons of coal annually. As of mid-October 1976, utilities had a little more than two-thirds of this ten years of incremental coal demand for new units under contract, about 243 million tons.

### PETROLEUM

*REFER ALSO TO CITATION(S) 20937, 20938, 21035, 21714*

**21728 (PB—269807) Pricing effects on frontier oil production. Final report.** (Gruy Federal, Inc., Arlington, Va. (USA)). 20 Jun 1977. Contract FEA-CR-05-60813-00. 273p. NTIS PC A12/MF A01.

This study was designed to analyze and evaluate the price effect on the rate and cost of converting the resource potential of frontier regions to produced oil. The frontier regions studied were: (1) Alaska - Onshore (Regions 18 and 19); (2) Lower 48 - Onshore (Deep Horizon); (3) Alaska - Offshore (Regions 20 and 21); (4) Pacific Offshore (Region 22); (5) Gulf of Mexico (Region 24). A computer model was developed to assess probable exploitation scenarios of future oil reserves in these regions.

**21729 (PB—269865) Outer Continental Shelf Sale 40: inadequate data used to select and evaluate lands to lease. Department of the Interior. Report to the Congress.** (General Accounting Office, Washington, D.C. (USA). Energy and Minerals Div.). 28 Jun 1977. 65p. (EMD—77-51). NTIS PC A04/MF A01.

This report describes how the United States selects and evaluates Outer Continental Shelf lands for leasing to develop do-

mestic oil and natural gas resources, and suggest ways to improve this Federal program.

**21730** (PB—270088) **Review of environmental issues of the transportation of Alaskan North Slope crude oil. Final report.** Brown, R.D.; Helfand, R.M. (Mitre Corp., McLean, Va. (USA). METREK Div.). May 1977. Contract EPA-68-01-3188. 137p. NTIS PC A07/MF A01.

This report summarizes existing information related to the transportation of Alaskan North Slope crude oil to U.S. markets. The report focuses upon various factors that have contributed to the need for transporting the crude to areas outside of the West Coast, the various alternatives proposed to distribute the excess oil, the environmental issues related to such distribution, and the research and development needs in areas where data are incomplete with respect to environmental issues.

**21731** (PB—270151) **Reference guide to changes in refiner and reseller pricing regulations and rulings.** (Price Waterhouse and Co., Washington, D.C. (USA). Office of Government Services). Mar 1977. Contract FEA-CR-06-77-4463-0. 149p. NTIS PC A07/MF A01.

The reference guide has been written to assist the FEA auditor in understanding the history of the FEA refiners and resellers pricing regulations. It is written in non-legal language for easy reading; it presents a discussion of main topics within the regulations (crude oil costs, non-product costs, etc.) followed by time flow charts. The discussions and charts offer an overview of the rules and changes.

**21732** (PB—270152) **Reference guide to changes in reseller pricing regulations and rulings.** (Price Waterhouse and Co., Washington, D.C. (USA). Office of Government Services). Mar 1977. Contract CR-06-70002-00. 54p. NTIS PC A04/MF A01.

The reference guide has been written to assist the FEA auditor in understanding the history of the FEA resellers pricing regulations. It is written in non-legal language for easy reading. The Reference Guide presents a discussion of main topics within the regulations (crude oil costs, non-product costs, etc.) followed by time flow charts. The discussions and charts offer an overview of the rules and changes.

**21733** (PB—270153) **Digest of Federal Registers.** (Price Waterhouse and Co., Washington, D.C. (USA). Office of Government Services). Mar 1977. Contract FEA-CR-06-70002-00. 301p. NTIS PC A14/MF A01.

The Digest is a compilation of the changes to Refiner and Reseller Pricing Regulations as they appeared in the Federal Register. Included in the Digest are the preambles and Rulings in addition to the actual regulation language.

**21734** **Future world demand and supply trends in the lubricating oil industry.** *OAPEC News Bull.;* **4**: No. 1, 9-16(Jan 1978).

Worldwide availability of high-quality lubricating oils is vitally important to all aspects of industrial life and development. A brief outline is given of the complex lubricant business and the historical development of supply sources. Present demand and supply capabilities are discussed together with growth-rate predictions and the factors that influence future demand. It is concluded that present manufacturing capacity is adequate to meet demand for the next five years and that long-term supplies of paraffinic crudes suitable for lubricating oils will be adequate. Present prices of lubricants, however, are discouraging manufacturers from investing in new or replacement plants.

**21735** **Norway's oil and gas wealth stimulates industrial growth.** Swiss, M. *Energy Int.;* **15**: No. 1, 9-12(Jan 1978).

Norway, a major exporter of oil and gas since the discovery of North Sea reserves, has seen a buildup of facilities and industries although it is planning a cautious development program. Hydroelectric power is already meeting Norway's energy needs and this factor, plus limited refineries and a difficult terrain, encourages exports to other European countries. The status of several gas and oil fields is reviewed along with some of the factors complicating their development. A boundary controversy, for example, has developed with the Soviet Union in the northern area, where both military and economic implications are involved. Norwegian safety standards for offshore construction and operations are very strict and reflect an awareness that exploration in the extreme north brings new potential hazards if oil should spill beneath the ice.

## NATURAL GAS

*REFER ALSO TO CITATION(S) 20937, 20938, 21061, 21714, 21729, 21735, 21738, 21813, 21814, 21815*

**21736** (PB—269528) **Economic analysis of Alaskan royalty gas contracts. A report to State of Alaska: the legislature.** (Alaska State Legislature, Juneau (USA)). 1977. 50p. NTIS PC A03/MF A01.

Three contracts for the sale of the State of Alaska's royalty gas from the leases on the Prudhoe Bay oil and gas field have been negotiated by the State of Alaska with Tenneco Alaska, Inc., El Paso Natural Gas Company, and Southern Natural Gas Company. These contracts must be approved by a majority of each House of the Alaska State Legislature. The purpose of this analysis is to determine if the contracts protect the interests of the State of Alaska.

**21737** **Australia examines gas industry's future.** Scott, W.E. *Energy Int.;* **15**: No. 1, 21-24(Jan 1978).

The Australian natural gas industry, seeking to increase supplies to the eastern states, is debating how new fields in the North West Shelf can be exploited and still protect the national interest. The development of Australian Gas Light Co. price schemes for natural gas influenced the size and character of the natural gas pipeline systems. Plans for transmission to Sydney and schemes to convert industrial consumers to gas are described. The present depressed economic condition has made capital difficult to raise for conversion, already under fire from the resisting oil companies. Opposition to a transcontinental gas pipeline points to the potential for finding reserves in the eastern and central states and the renewed interest in exploration following new pricing policies for crude oil. Future demand for natural gas will be affected by the price and the relative costs of competing fuels. The future effects of North West Shelf development, liquefied natural gas export schemes, synthetic natural gas research, and storage projects are described.

## HYDROGEN AND SYNTHETIC FUELS

**21738** (TID—28025) **Developing a SNG feedstock allocation scheme that reflects a sound national policy on SNG. Attachment A. Worksheets for efficiency, costs, and emissions analysis. Attachment B. Major sources of data.** (Resource Planning Associates, Inc., Cambridge, Mass. (USA)). 2 Aug 1977. 311p. MF A01.

Portions of document are illegible.

An analysis was made of existing SNG (synthetic natural gas) regulations, their relationship to current energy supply and demand patterns and levels, and their relationship to the probable energy situation that will exist as a result of the Administration's national energy plan. The analysis was made on the basis of the policy-development guidelines that SNG policy and the resulting SNG-plant feedstock allocations must be designed to distribute impacts evenly among users, SNG policy must be economically sound, and SNG policy should be compatible with the general policy of energy conservation and careful use of gaseous fuels. SNG was defined as the high Btu gas made from petroleum feedstocks and excluded coal gasification. The major conclusions drawn were the following. SNG does not represent a viable, long-term solution to declining natural gas supplies, but it can be used in the short-term until a more rational gaseous fuels policy is developed and implemented. The FEA should develop quickly a feedstocks allocation scheme that facilitates and encourages SNG production and use in the short-term but minimizes its long-term development. In addition a step-by-step allocation procedure is provided that can be used in analyzing any SNG feedstock application.

## ELECTRIC POWER

*REFER ALSO TO CITATION(S) 21714*

**21739** (CONF-7710101—1) **Transition to decentralized energy systems.** Cavallo, J.; Krohm, G. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 8p. Dep. NTIS, PC A02/MF A01.

From 5. national conference on energy and the environment; Cincinnati, OH, USA (31 Oct 1977).

Alternative system designs are compared for annualized costs and reliability. The alternative base- and intermediate-load generating plants tested are conventional large nuclear and coal units and small (120-MW) fluidized-bed coal-combustion units. To estimate costs while holding reliability roughly constant, the Wein Automatic System Planning (WASP-II) model was used. The model enables the analyst to specify a number of alternative generating technologies, various expansion paths, and reliability constraints. The program calculates system configurations compatible with the reliability constraints, finds the optimum configuration, and estimates the operating and capital costs. The results were derived from permitting the model to choose from system designs which were: (a) entirely conventional coal and nuclear (referred to as the Base Case) and (b) a combination of conventional coal, nuclear, and fluidized-bed units. Furthermore, several tests with alternative reliability and cost estimates for fluidized-bed combustion were made to test the sensitivity of the results to these parameters. These sensitivity tests are particularly important since fluidized-bed is an emerging technology without proven performance characteristics.

**21740** (CONF-7710101—5) **Long-term availability of water resources for energy development in the central United States.** Habegger, L.J.; Chiu, S.Y.; Hoover, L.J. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 9p. Dep. NTIS, PC A02/MF A01.

From 5. national conference on energy and the environment; Cincinnati, OH, USA (31 Oct 1977).

As part of an integrated assessment of impacts and constraints related to future energy development, an analysis has been made of water resources and demands over the next 40 to 50 years in the Central U.S. Included in the analysis are portions of the Great Lakes Basin and the Upper and Lower Mississippi, Ohio, Missouri, Souris-Red-Rainy, and Arkansas-White-Red River Basins. Although cumulative water supplies are adequate in this region to satisfy foreseeable energy requirements, this paper identifies various subregions in which significant water shortages are likely to occur. These shortages would constrain energy-development patterns, restrict development of competing water uses, or alternatively, require implementation of water-resource-enhancement options.

**21741** (PB—269348) **Electric utilities captive coal operations.** (Federal Power Commission, Washington, D.C. (USA). Bureau of Power). Jun 1977. 45p. NTIS PC A03/MF A01.

Captive coal is defined as outright ownership and operation of a coal mine, ownership of coal reserves with another company mining the coal, or having a loan guarantee arrangement with a coal mining company. In 1965 only 13.4 milliion tons or about 5.5 percent of all coal used in electric utilties came from captive mines. By 1975, however, 27 electric utilities were using 48.4 million tons of captive coal, or 11.2 percent of all coal used in the industry.

**21742** (SIND-PM—1977-3) **Industry in national planning: the power industry.** (Statens Industriverk, Stockholm (Sweden)). 1977. 180p. (In Swedish). Dep. NTIS (US Sales Only), PC A09/MF A01.

The aim of this report is to investigate the need for production and transmission facilities of the power industry. Forecasts are made for 1985 and for 2005. For the latter, calculations are made for two different consumption levels and two alternative production systems. In one of the alternatives, nuclear energy will produce most of the electricity needed due to the increase of demand. In the other alternative, power will be produced in fossil-fueled power plants after 1985.

**21743** (TID—28064) **Impacts of the western drought on the regional electricity situation.** (Federal Power Commission, Washington, D.C. (USA); Federal Energy Administration, Washington, D.C. (USA)). 30 Sep 1977. 154p. Dep. NTIS, PC A08/MF A01.

The projected electrical demand and supply situation in the West are examined, with particular emphasis on the Pacific Northwest situation during the winter of 1977. While the projected shortage of energy is small, continued lack of precipitation and failure to pursue conservation measures could result in a more critical situation. An interim report published on March 31, placed emphasis on the California situation; this report updates that evaluation and presents new information based on the Pacific Northwest's winter electricity outlook. Drought conditions have decreased the ability of some hydroelectric plants to produce sufficient electric energy necessary to maintain power supply to interruptible customers and, potentially, to firm customers. The largest coordinating group of electric utilities in the drought area is the Northwest Power Pool (NWPP), which is part of an interconnected network of power plants and transmission facilities within the Western Systems Coordinating Council (WSCC), a voluntary association of utilities serving all or part of 14 states, and a portion of Canada. In the U.S. portion of NWPP, where 66.3% of the projected winter energy will be from hydroelectric facilities, the proportion of hydroelectric to thermal generation is much higher than in the other WSCC areas. It is unlikely that existing water shortfalls can be replenished, although increased precipitation may alleviate problems in some areas. The reduced water supplies have created the prospect of inadequate hydroelectric generation and the need for other measures to respond to regional electricity demands. These conditions are reviewed and the results are summarized, focusing on the period of October, 1977 through March, 1978.

**21744** **Industrial electric power rates in the mid-1980s.** Mangione, B. (Gilbert/Commonwealth, Reading, Pa). *Tappi;* **60**: No. 9, 83-87(Sep 1977).

New power plant units committed in the late 1960s and early 1970s, which will be built at higher capital costs and higher financing charges, and the phasing in of higher fossil-fuel costs will cause sizable rate increases over the next 8-10 years. This paper presents one technique for forecasting these future rate increases. Industrial electric unit costs for 1985 are projected for a northeastern United States utility company, taking into account the impact of the major parameters of fuel, cost of capital, and the utility's rate base. For the electric utility system cited as an example in this paper, purchased-power costs for the industrial customer in 1985 are projected to be 100-160% over 1976 costs--or 4.88-6.20$cent$/kW*hr based on "cost to serve" and on system fuel costing $2.50/MMBtu. A sensitivity analysis examined the effect of changes in fuel costs, new rate design proposals, and financing costs on kW-$multiplied by (times)$hr to a projected 1985 base rate of 3.28$cent$/kW$multiplied by (times)$hr. This is to be compared to the actual unit cost rate of 2.40$cent$/kW$multiplied by (times)$hr in 1976.

**21745** **Proceedings of the twelfth session of the Sub-Committee on Energy Resources and Electric Power.** New York; United Nations (1974). 324p. (CONF-721247—). .

From 12. session of the sub-committee on energy resources and electric power; Bangkok, Thailand (6 Dec 1972).

The report and documents of the twelfth session of the Sub-Committee on Energy Resources and Electric Power (6 to 13 December 1972), organized by the United Nations Economic Commission for Asia and the Far East (ECAFE) at Bangkok, Thailand are presented in two parts. Part I includes the report of the Sub-Committee. Part II contains documents presented at the session and divided into the following sections: working papers prepared by the secretariat; information papers prepared by other United Nations bodies; and information papers presented by Governments. Some of the papers have been abridged. Information is included on rural electrification, power demand; nuclear, hydro, and fossil-fuel power plants; training of power industry personnel; and energy resources development in locations such as Australia, New Zealand, Thailand, Japan, Vietnam, Indonesia, Malaysia, Korea, and Singapore. (LCL)

## ELECTRIC POWER GENERATION

*REFER ALSO TO CITATION(S) 21524, 21684, 21727*

**21746** **Regulatory constraints on solar energy and thermal-storage installations.** Koger, R.K. *Public Util. Fortn.;* **101**: No. 2, 9-12(19 Jan 1978).

The market penetration of new technologies such as centralized solar or thermal storage systems will be influenced by the pricing policies of public service commissions. The growth of energy demand in North Carolina and recent supply difficulties there are used as an economic background for discussing the issue of whether cost of service should be applied to backup solar installations. Evidence indicates that the fixed charges on power facilities are not reduced when solar equipment is introduced because peak demand remains about the same. On the other hand, time-of-day pricing policies could encourage customers with solar equipment to lower their peak demand by installing more thermal-storage capacity. If the electricity supply savings are computed on the basis of storage costs, a solar installation can be shown to be cost-effective. But if off-peak power prices are low, as is true in North Carolina, capital-intensive solar installations are not presently economic. A more promising case is made for retrofitting or equipping new buildings with thermal-storage systems. More electric usage data is needed to determine the extent and desirability of subsidizing solar-heating customers at either the local utility or Federal level.

**21747** **No uranium OPEC to be evoked as a phantom.** Riemer, H.L. (Ministerium fuer Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). *Energie;* **29**: No. 7, 190-192(Jul 1977). (In German).

Within the framework of generating 250 million tons of German coal into electricity by 1987, clean air standards, the construction of additional coal-fired power stations, effects of the construction of new coal-fired power stations and nuclear power plants on national economy and employment, and the nuclear energy situation are commented on.

## ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

**21748** (PB—269614) **Problems in planning and constructing transmission lines which interconnect utilities: Federal Power Commission.** (General Accounting Office, Washington, D.C. (USA). Energy and Minerals Div.). 9 Jun 1977. 50p. (EMD—77-21). NTIS PC A03/MF A01.

According to Federal and independent power studies, future reliability and adequacy of the electric power supply depends on the timely installation of generating and transmitting facilities to meet our future needs. The Federal Power Commission should: (1) take the lead in promoting joint Federal-industry studies to identify and evaluate new interconnections and changes in existing interconnections; (2) follow up on completed studies to resolve objections that might frustrate the adoption of study recommendations; (3) work with utilities to establish criteria for interconnection studies, which will adequately consider national goals and identify factors that may adversely affect proposed interconnections; and (4) work with utilities to make sure they use the criteria in both industry and Federal studies.

## CONSUMPTION AND UTILIZATION

*REFER ALSO TO CITATION(S) 21681, 21682*

**21749** (FEA/D—77/140) **Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables.** (Federal Energy Administration, Washington, D.C. (USA); Department of Agriculture, Washington, D.C. (USA)). Apr 1977. 85p. Dep. NTIS, PC A05/MF A01.

This is the second of a three-volume publication presenting the results of a comprehensive investigation of energy use in agricultural production. This volume features energy use estimates for each of 27 crop and 10 livestock commodities. The energy estimates presented herein have been developed to satisfy essential information requirements of legislators, policymakers, researchers, and conservation strategists. Accordingly, the data base has been structured to allow disaggregation in five dimensions: energy, geography, commodity, time, and functional use. The data base includes energy use for on-farm business purposes for the year 1974 and is reflective of cultural practices and technology associated with the bulk of agricultural production.

**21750** **Increasing energy consumption: will the plans be followed.** Nordstroem, S.; Norhammar, U. (Aangpannefoereningen, Stockholm). *Tek. Tidskr.;* **106**: No. 12, 24-28(1976). (In Swedish).

This article deals with the 1975 Swedish energy balance. The following points are discussed: Swedish energy policy, energy consumption, energy production and import, distribution over different energy sources, nuclear reactor availability, energy taxes, and industrial and governmental energy organizations.

### SOLAR

*REFER ALSO TO CITATION(S) 21323, 21324, 21325, 21421, 21746*

### GEOTHERMAL

*REFER ALSO TO CITATION(S) 21390, 21413, 21414, 21415, 21416, 21417, 21418, 21419, 21420, 21422, 21423, 21424, 21425, 21426, 21427, 21428, 21429, 21430, 21431, 21435, 21450*

### OTHER

*REFER ALSO TO CITATION(S) 21310*

# ENERGY CONVERSION

## MHD GENERATORS

**21751** **MHD power generation: a technology of future.** Ramanna, R. (Bhabha Atomic Research Centre, Bombay). *Bull. Inst. Eng. (India);* **26**: No. 7, 13-16, 19(Jan 1977).

From 13. Mysore Engineers' Association commemoration lecture; Bangalore, India (6 Nov 1976).

Principles of the various types of MHD generators are reviewed, and the current status of MHD generator technology is summarized. The Indian MHD program is described, and future prospects for MHD power plants are discussed. (WHK)

### DESIGN AND DEVELOPMENT

*REFER ALSO TO CITATION(S) 20855*

**21752** (FE—2015-12) **Development program for MHD power generation. Quarterly report, April 1976—June 1976.** Demirjian, A.; Gannon, R.E.; Hruby, V.; Klepeis, J.E.; Petty, S.W.; Solbes, A.; Ubhayakar, S. (Avco-Everett Research Lab., Inc., Everett, Mass. (USA)). Aug 1977. Contract EX-76-C-01-2015. 67p. Dep. NTIS, PC A04/MF A01.

Laboratory analyses of the Mark VI channel wall samples after the 100 hour test are discussed and conclusions and recommendations are presented. Experimental operations during the period have concentrated on loading the Mark VI C channel as an ideal Faraday with very favorable results. Twenty-two tests were conducted in the period totaling 71 thermal and 32 power hours. There was one forced shutdown attributable to a channel related problem. Measurements were made of the voltage-current characteristics of slag covered interelectrode gaps on all channel walls and breakdown voltages were recorded. Investigations of leakage current behavior with and without seed were also conducted and indicate that elevated temperatures of slag walls in the presence of high Hall fields may impose a real constraint on channel design. A description of spinel electrodes with a new attachment technique to the metal electrode base is presented. Also described and illustrated is a new wall design utilizing fiberglass tie rods for compression loading of boron nitride insulators sandwiched between metal electrode elements. New peg wall designs for diagnostic experiments are also discussed in detail. Design and construction of the new Electrode Test Section and Mark VI D channel (V shaped electrodes) are on schedule. Descriptions and sketches of both items of experimental hardware are given. The performance of the gasifier for coal devolatization was studied, and indicates the existence of imperfect thermochemical equilibrium in the gasifier. Studies on the ignition, flame holding and burnout of pulverized coal injected into hot oxidizing gases have been initiated. MHD cycles using low Btu gas produced in a devolatilizer via rapid pyrolysis are currently being analysed and compared with a similar cycle using other sources of clean fuel. (WHK)

**21753** (FE—2015-21) **Development program for MHD power generation. Quarterly report, October 1976—December 1976.** Becker, F.E.; Demirjian, A.M.; Kessler, R.; Klepeis, J.E.; Petty, S.W.; Sadovnik, I.; Solbes, A.; Ubhayakar, S. (Avco-Everett Research Lab., Inc., Everett, Mass. (USA)). Mar 1977. Contract EX-76-C-01-2015. 136p. Dep. NTIS, PC A07/MF A01.

The objective of the program is the continuation of essential experimental work aimed toward the demonstration of long duration MHD generator operation with the extraction of practical power levels from open cycle MHD generators. The present program will ultimately lead to the delivery, installation and test of generators of 40 to 50 MWt capacity at the CDIF in Butte, Montana. Progress during the three month period for each of the five program tasks is presented. Preliminary performance and lofting calculations are presented for the first CDIF power channel to be operated in a 3 teslas iron core magnet in conjunction with the PERC combustor. These calculations help formulate magnet and combustor operation specifications together with cooling and instrumentation requirements for the channel. The Electrode Test Section has been completed and been subjected to three tests, with a cumulative duration of 9.2 hours. Experiments were performed in order to assess the effectiveness of current controls for a generator with external diagonal connections. The most recent experiments on the disk generator utilize radial flow and a working fluid that is a very close simulation of the combustion products of coal burned with preheated air. Nominal channel mass flows are 30 kg/sec at a corresponding enthalpy flow of 120 MWth. Experiments yielded a peak output power of 3 megawatts for an applied magnetic field of 2 tesla. Modification of the high temperature regenerative air preheater facility and assembly of the coal combustion research test rig was completed. Studies on the behavior of coal particles when injected into hot vitiated air were continued. (WHK)

**21754** (FE—2215-7) **Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976—February 28, 1977.** Louis, J.F. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Aug 1977. Contract EX-76-C-01-2215. 159p. Dep. NTIS, PC A08/MF A01.

Research progress in open-cycle coal-fired MHD power generation at Massachusetts Institute of Technology (MIT) is reported. The scope and objectives of the MIT program are to: (1) Establish chemical, thermal, and electrical data to guide materials selection, develop improved detail designs, and support performance analyses of MHD electrode modules and insulator materials; (2) establish basic mechanical properties to guide detail design and fabrication of high field strength superconducting magnets for MHD applications; (3) parametrically investigate selected electrode properties of critical design importance in chemical, thermal, and electrical environments simulating a coal-fired MHD generator; (4) develop combustion data pertinent to the design of MHD combustors; (5) establish techniques for the analysis and understanding of critical MHD phenomena which have an important bearing on MHD generator performance; such phenomena include inter-electrode breakdown, time-dependent behavior, effective plasma properties and plasma inhomogeneities; (6) establish the operating characteristics of an MHD disk generator; (7) continue work on computer techniques for modeling and for design and cost analysis of MHD components and the overall system; (8) integrate the engineering data and design criteria, as applicable, which are developed in the above-listed tasks into a model of the MHD channel; (9) Participate in technical support of the ERDA MHD Project Office; (10) participate in the US/USSR Cooperative Program in MHD Power Generation. (11) During the summer of 1976, a short-term task in U-25 electrode screening was temporarily added to the scope of the contract. This effort involved screening tests, in the MIT MHD simulation facility of electrode modules and configurations intended for tests in the Soviet U-25 generator.

**21755** (TID—27152) **CDIF-MHD generator system conceptual design.** (Systems Research Labs., Inc., Dayton, Ohio (USA)). Feb 1977. Contract W-31-109-ENG-38;W-31-109-ENG-3635. 355p. Dep. NTIS, PC A15/MF A01.

This report has been organized as follows. Section II, System Design, includes the final report by J.B. Dicks and Associates, Inc.

(JBDA). The report by JBDA includes preliminary ETF calculations, CDIF-ETF scaling, CDIF channel design, off-design point operation calculations, channel operation instrumentation, electrode recommendations, and inverter loading techniques. Additional system design information in this section includes the nozzle and diffuser design and comments on the anticipated or recommended magnet design approach as well as diagnostic and test instrumentation. Section III, System Hardware Design and Construction, includes descriptions of the nozzle, channel, channel electrode, diffuser, inverter, and instrumentation fabrication techniques. Section IV, Facility Requirements, describes the utility services and space required. Section V, Codes and Standards, describes the applicable construction codes and standards for the various components. Section VI. Program Plan, Schedule, and System Testing, describes the approach to detail design, construction, preliminary component testing and system testing. Section VII, Drawings, includes all layouts, detail drawings, assemblies, and sketches with the exception of those included in the report by JBDA and those used as part of and in explanation of the test. Section VIII, Recommendations for Support Research, includes recommended study and research projects in support of the CDIF project. Section IX, Alternative Combustor and Fuel Preparation, includes a brief descritpion of the possible use of a liquid fueled coal combustor and the method of fuel preparation in the event that the use of powdered coal in a combustor presents engineering development problems which cannot be solved within the project schedule timing.

**21756 Dependence of current density and intensity of electric field on pulsation of thermodynamic parameters of plasma in a MHD generator.** Kapron, H. (Wyzsza Azk Inz, Lublin, Pol). *Arch. Elektrotech. (Warsaw);* **25**: No. 4, 1069-1084(1976). (In Polish).

The investigation of pulsation in MHD generators is described. The effect of pulsation of the thermodynamic parameters on the electric parameters of the MHD generator is presented using the method of small disturbances. The results of this investigation led to formulas for instantaneous and average values of electrical conductivity, the Hall parameter, current density and intensity of electrical field. 13 refs.

## PERFORMANCE AND TESTING

*REFER ALSO TO CITATION(S) 21755*

**21757 Investigation of a high-efficiency MHD generator with nonequilibrium conductivity.** Belykh, A.D.; Gurashvili, V.A.; Golubev, V.S. (Inst. of Atomic Energy, Moscow). *Teplofiz. Vys. Temp.;* **13**: 1064-1071(1975). (In Russian).

Results are presented for an experimental study of a pulsed (2 microsec) MHD generator characterized by a nonequilibrium conductivity of the plasma. The experiments were carried out with a supersonic Faraday MHD channel in the case of full thermal power for the flow of the working medium (argon with cesium) up to 8 MW and stagnation temperatures of 5000 to 9000°K. The discussion covers measurements of the electrical and gasdynamic parameters of the MHD channel and various parameters of the plasma. It is shown that an effective MHD conversion from thermal to electrical energy with an up to 30% efficiency can be achieved under conditions of nonequilibrium conductivity of the plasma characterized by ionization turbulence, where the plasma is divided into layers located at an angle of 40 to 50° to the average Faraday current.

## MATERIALS, COMPONENTS, AND AUXILIARIES

*REFER ALSO TO CITATION(S) 21241, 21752, 21753, 21754*

**21758** (BNWL—2004-6) **Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977.** Bates, J.L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-06-1830. 112p. Dep. NTIS, PC A06/MF A01.

The objectives of this program are to develop, test, characterize, and evaluate materials for open-cycle, coal-fired MHD power generators. The specific immediate goals emphasize electrode and insulator materials, including: (1) testing and evaluation of the enhanced effects of alkali seed on materials in a dc electric field; (2) development and testing of improved electrodes and insulators with controlled microstructures, compositions and properties; and (3) characterization and evaluation of materials relating to both the US MHD Program and the US-USSR Cooperative Program for MHD power generators. Detailed results are presented.

**21759** (FE—2295-1) **Superconducting magnetohydrodynamics magnet development program: Phase I. Quarterly technical progress report No. 3 (Revision A), November 1, 1976—January 31, 1977.** Williams, J.E.C. (Massachusetts Inst. of Tech., Cambridge (USA). National Magnet Lab.). Mar 1977. Contract EX-76-C-01-2295. 56p. Dep. NTIS, PC A04/MF A01.

Research progress in the development of a superconducting magnet for an MHD generator. Topics discussed inlude vaporlocking in pulse conditions, theoretical stability criteria, frictional heat generation, the test facility, technical support to ERDA, conductor development, and general stress analysis. (WHK)

**21760** (N—77-26439) **Numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature.** Geutjes, A.J. (Technische Hogeschool Eindhoven (Netherlands). Afdeling der Elektrotechniek). Nov 1976. 46p. (TH—76-E-66). NTIS PC A03/MF A01.

A mathematical model describing the heat transport in regenerative heat exchangers for an experimental MHD generator is presented. Solution of the set of equations by the method of successive overrelaxation results in the gas and material temperature along the height of the regenerator during the heating and cooling period is described. The temperature of the argon gas leaving the heater was also found. Calculations were made for heat exchangers filled with spheres and for heaters filled with cored bricks. In the first computations the inlet temperature and composition of the combustion gas were taken as constant. Axial heat conduction was assumed negligible. Radiative heat transfer from the combustion gas was included in the model. The results of the study are in qualitative agreement with experimental data. A quantitative comparison between this theory and experiments was hampered by lack of information regarding the burner settings during the heating period.

**21761 Efficiency of various systems for lead-in and lead-out of an ionizing additive for a power station with an open-cycle MHD generator.** Mostinskii, I.L.; Monastyrskaya, A.R.; Khokhlov, L.K. (AN SSSR, Moscow. Inst. Vysokikh Temperatur; Moskovskij Ehnergeticheskij Inst. (USSR)). *Teploenergetika (Moscow);* No. 11, 16-18(Nov 1975). (In Russian).

The efficiency of the MHD generator depends on the quantity and method of introduction of additions. In order to perform a cost effectiveness study of input/output system of ionizing addition a comparative analysis is carried out of five of the most promising systems for a MHD power plant of the open-cycle type: dry input and output through cloth bag-type filters; dry input and output through combined electrical filters; wet input and output through high-pressure turbulent flushing with a preliminary moistening in a foam apparatus; wet input and output through the turbulent flushing with the preliminary moistening in a low-pressure Venturi tube; wet input and output through a wet electrical filter with a preliminary moistening in a low-pressure turbulent flushing apparatus. It is shown that the system with the addition output by means of a set of Venturi tubes has minimal dimensions. For the ionizing addition system at $h < 2000$ h/year the wet input and output through a wet electrical filter is recommended. For a significant deposition (up to 50% and more) of the addition on the output system, the output system with the set of Venturi tubes is necessary.

**21762 Magnetohydrodynamic electrode.** Boquist, C.W.; Marchant, D.D. (to Energy Research and Development Administration). US Patent Application 745,942. 1976. Filed date 29 Nov 1976. 10p.

A ceramic-metal composite suitable for use in a high-temperature environment consists of a refractory ceramic matrix containing 10 to 50 volume percent of a continuous high-temperature metal reinforcement. In a specific application of the composite, as an electrode in a magnetohydrodynamic generator, the one surface of the electrode which contacts the MHD fluid may have a layer of varying thickness of nonreinforced refractory ceramic for electrode temperature control. The side walls of the electrode may be coated with a refractory ceramic insulator. Also described is an electrode-insulator system for a MHD channel.

**21763 Investigation of the combustion chamber of an experimental MHD generator and some problems of updating.** Borblik, E.L.; Butovskii, L.S.; Zholudov, Ya.S.; Lyubchik, G.N.; Nekhamin, M.M.; Chmel, V.N. pp 25-36 of In Voprosy MGD-preobrazovaniya energii. Kiev; Naukova Dumka (1975). (In Russian)

The paper presents data of an experimental study of a pilot MHD generator with straight-flow combustion chamber. An analysis of the results of tests of a modified version of the plasma generator showed that one way to improve the system is to use a bluff body (pylon) as a fuel-feeding and stabilizing element. It is noted that future work on updating the combustion chamber should be directed toward reducing the intensity of fluctuations in parameters.

## DUCT ENGINEERING AND FLUID DYNAMICS

*REFER ALSO TO CITATION(S) 21752, 21753, 21754*

**21764** (FE—2243-9) **U-25-C MHD channel analysis open circuit operation. Interim report: Subtask 1 (B). Revision A.** Demetriades, S.T. (STD Research Corp., Arcadia, Calif. (USA)). 20 Sep 1977. Contract EX-76-C-01-2243. 92p. Dep. NTIS, PC A05/MF A01.

An analytical evaluation of the performance of the U-25 C channel operating in an open circuit configuration was carried out utilizing the MHD channel codes of STD Research Corporation. The cases studied include three combinations of sidewall and electrode wall temperature (2100 K--2100 K, 500 K--2100 K, and 500 K--500 K), with the 500 K electrodes operating in the arc mode. For each case, a range of diffuser recovery coefficients were employed, assuming the diffuser exit pressure to be 1.1 atm at full design flow rate. The data obtained gives a complete picture of the gasdynamic and electric/current density fields in this mode of operation. Of particular importance is the boundary layer separation discovered at the channel exit, a feature which significantly disturbs the stability and performance of the diffuser.

**21765** (FE—2341-2) **High magnetic field MHD generator program. Quarterly report, January—March 1977.** Eustis, R.H.; Kruger, C.H.; Mitchner, M.; Self, S.A.; Koester, J.K. (Stanford Univ., Calif. (USA)). Apr 1977. Contract EX-76-C-01-2341. 67p. Dep. NTIS, PC A04/MF A01.

Technical and programmatic progress on research related to high magnetic field effects in MHD generators is reported. Analysis of the data obtained in an experiment to determine the possible growth of pressure fluctuations showed that the observed increase in fluctuation amplitude at 2.4 tesla compared to zero field (up to a factor of 4) occurred primarily at low frequencies in the range up to 100 Hz. Line-reversal measurements in the presence of fluctuations and nonuniformities have been analyzed and an experimental procedure has been developed for measuring bulk temperature fluctuation levels in certain combustion flows. Progress toward measurement of the sidewall boundary layer profiles has proceeded with a checkout of the thermal performance of the new hardware and of the scanning laser anemometry. Further experiments related to the Hall field breakdown problem have shown that insulator dominated breakdown with induced fields is qualitatively similar to that observed in applied field experiments. Progress on the combustion disk generator work has included thermal and electrical insulation tests of designs for the disk plate, and cold flow tests of the generator entry region.

**21766 Combined influence of Hall effect, ion slip and temperature boundary condition of third kind on MHD channel flow heat transfer.** Javeri, V. (Inst fuer Reakt, Koeln, Ger). *Appl. Sci. Res. (The Hague);* **33**: No. 1, 11-22(Feb 1977).

To investigate the combined influence of Hall effect, ion slip and the temperature boundary condition of the third kind on the magnetohydrodynamic heat transfer in the thermal entrance region of a flat channel, the energy equation is solved by employing the Galerkin-Kantorowich method of variational calculus. The heat generation within the fluid is neglected. It is concluded that there can be a significant influence of Biot number and Hall parameter on the local Nusselt number. Representative results are depicted in tables. 15 refs.

**21767 Energy estimates of nonequilibrium ionization using external sources in MHD generator channel.** Trushin, V.S. (Scientific-Industrial Society of Energy, Moscow). *Teplofiz. Vys. Temp.;* **13**: 1052-1058(1975). (In Russian).

The energy aspects of using external sources for producing elevated electrical conductivity in the channel of a closed-loop MHD generator are discussed. Conditions are determined under which suppression of instabilities arising generally in the MHD generator channel is energetically advantageous. From this same viewpoint, in the absence of instabilities, the possibilities of ionization with only external sources as related to corpuscular radiation and photoionization are evaluated.

**21768 Experimental determination of the Hall parameter from the local characteristics of a MHD generator.** Beloglazov, A.A.; Kirillov, V.V.; Panovko, M.Y.; Sokolov, Y.N. (Scientific-Research Inst. of High Temperature, Moscow). *Teplofiz. Vys. Temp.;* **13**: 1059-1063(1975). (In Russian).

A technique is proposed for an accurate measurement of the Hall parameter for the combustion products of a natural gas in a MHD generator channel with hot ceramic electrodes for a 40% oxygen content in the air. The Hall parameter is calculated from the Ohm law for the transverse component of the current density formulated for the flow core referred to as the plasma region confined between the insulation walls and the boundary layers at the electrode wall. A least-squares treatment of experimental results shows a linear relationship between the Hall parameter and the induction of the applied magnetic field.

### MATERIALS, COMPONENTS, AND AUXILIARIES

*REFER ALSO TO CITATION(S) 21915*

## FUEL CELLS

### DESIGN AND DEVELOPMENT

*REFER ALSO TO CITATION(S) 21521*

**21769 Fuel cell.** Cheron, J. (to to Institut Francais du Petrole (IFP)). German(FRG) Patent 2,545,098/A/. 22 Apr 1976. 11p. (In German).

The heat exchangers, pumps and stores required in the electrolyte circulation system of fuel cells are arranged as follows, according to the invention, in order to improve circulation: The electrolyte at atmospheric pressure flows through a heat exchanger, which produces a pressure drop of a certain value between electrolyte store and electrolyte circulating pump. Store and pump are in such relative positions that the outlet opening of the store is situated on level which lies above that of the inlet opening of the pump. The value of pressure loss produced lies between the value of the hydrostatic head of the electrolyte at the outlet opening of the pump and the value of the delivery pressure of the pump.

### MATERIALS, COMPONENTS, AND AUXILIARIES

**21770 Vacuum-microgravimetric characterization of catalyst candidates for fuel cell electrodes.** Behret, H.; Binder, H.; Robens, E. (Battelle Inst, Frankfurt AM, Ger). *Vak.-Tech.;* **26**: No. 5, 147-148(Jul 1977). (In German).

In the search for noble--metal-free cathode materials resistant to acid electrolytes and capable of catalysing the conversion of oxygen, thermogravimetric methods have been used to determine the conditions of preparation, to analyse the chemical properties, and to characterise the pore structure of the potential catalysts. Results are presented of investigations on inorganic compounds, such as ammonium tungstates, chromates, vanadates, molybdate and permanganate, and on organic polymers, such as polyamide nitriles, other CN polymers and polyacenoquinone pyrolysates. 4 refs.

# ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

## BUILDINGS

*REFER ALSO TO CITATION(S) 21335, 21708*

**21771** (AED-Conf—1977-072-010) **Experiences with heat pumps in heat recovery from the ground.** Spanke, D. (Schleswag A.G., Rendsburg (Germany, F.R.)). 1977. 11p. (In German). Dep. NTIS (US Sales Only), PC A02/MF A01.

Experiments made with heat pumps using the ground as a heat source are reported. Polyethylene pipes were installed at a depth of 1.2 to 1.8 m and the working fluid was a mixture of water and glycol. The parameters affecting the efficiency of the pump were indicated with the comment that these are as yet unquantified in many cases. The theoretical coefficient of performance of the heat pump should be 3.5 to 3.9 over a year's time. However, measurements made indicated that the actual performance was much lower. Possible reasons are tabulated. (JSR)

**21772** (COO/4490—1) **Use of fluidized bed heat exchangers in heat pump systems for improved performance. Technical status report, September 1, 1977—November 31, 1977.** Chen, J.C.; Sarubbi, R.G. (Lehigh Univ., Bethlehem, Pa. (USA)). Nov 1977. Contract EC-77-S-02-4490. 16p. Dep. NTIS, PC A02/MF A01.

A York (Split System) heat pump 60,000 BTUH has been selected, and one unit delivered, for use in comparing its coefficient of performance with an identical system using fluidized bed heat exchangers. Construction has begun on a plenum which will supply air over a wide range of operating temperatures and at flow rates and pressures which are comparable to normal operating conditions. Means for monitoring air flow rates have been decided upon and a tentative selection of instrumentation sensor points have been selected. The existing heat exchanger design is being examined so that a better knowledge of the complete range of operating pressures, temperatures, flow rates and refrigerant quality can be obtained.

**21773** (PB—269779) **Urea-formaldehyde based foam insulations: an assessment of their properties and performance. Final report.** Rossiter, W.J. Jr; Mathey, R.G.; Burch, D.M.; Pierce, E.T. (National Bureau of Standards, Washington, D.C. (USA). Center for Building Technology). Jul 1977. 96p. (NBS-TN—946). NTIS PC A05/MF A01.

The properties and performance of urea-formaldehyde based foams pertinent to their use as insulation in buildings were assessed

based essentially on existing information. Pertinent materials properties were identified and guidelines prepared for the suggested values of these properties along with corresponding methods of test. For certain materials properties information was not found to enable suggested values of these properties. The factors affecting performance of urea-formaldehyde based foam insulations were also identified and discussed. Some performance factors could not be adequately evaluated because of insufficient or contradictory data in the literature. Methods of foam application were studied and suggested general application guidelines were prepared. The advantages and disadvantages of using urea-formaldehyde based foam insulations were discussed and problem areas identified. Recommendations were made pertaining to the use and assessment of urea-formaldehyde based foam insulations for residential construction.

**21774 Thermally insulated panel.** Wyatt, W.B. Jr.; Benefield, B.D. (to Videre Corp.). US Patent 4,057,944. 15 Nov 1977. Filed date 11 Mar 1977. 4p.

A thermally insulated panel comprises a pair of spaced facing channels, preferably of metal, which are fixed together in a structurally secure manner by use of a serrated rigid plastic sheet disposed therebetween and by a closed-cell foamed polymeric material which fills the voids between the rigid sheet and the channels. The channels are bound together and the spacing between them is sealed by means on the rigid plastic sheet which, in addition to securing the channels together, is permanently and monolithically sealed in place by the closed-cell foamed polymeric material. A thermal break is formed to prevent loss of heat across the shell of the panel.

**21775 Insulating spacer for double insulated glass.** Kessler, G. US Patent 4,057,945. 15 Nov 1977. Filed date 19 Oct 1976. 6p.

An improved insulating spacer to reduce the heat transfer between the two panes of glass of double insulated glass comprises an extruded or roll-formed metal spacer together with plastic insulating elements which thermally isolate the metal spacer from the panes of glass while permitting conventional application of the sealant to provide reliable bonding. In one embodiment the plastic insulator comprises an extruded plastic overlay which fits tightly over part of a conventional metal spacer and has projecting contacts which abut the glass. In an alternative design the plastic insulator comprises extruded plastic strips which are attached through grooves in the metal spacer. In both designs the height of the insulating contact element can be selected to correspond to the desired gap width between the two glass plates.

**21776 Buchloe indoor swimming pool as an example of energy saving and environmentally beneficial system solution.** Wulff, H. *Elektrowaerme Int., Ed. A;* **35**: No. 4, 199-201(Jul 1977). (In German).

The article describes various items of equipment to show how an all-electric supply can be achieved in conjunction with a heat pump system in an indoor swimming pool. Where put into practice, an all-electric supply permits an interesting comparison to be made with conventional systems. Energy consumption figures were therefore evaluated early in 1977 in conjunction with the local power supply utility and the planner.

**21777 Strengths of building blocks containing shaped cavities for thermal insulation and rectification.** Baker, G.; McConnell, L.D.; Probert, S.D. (Cranfield Inst. of Tech., Bedford, Eng.). *Appl. Energy;* **3**: No. 3, 153-165(Jul 1977).

A stress analysis investigation is presented of a building block incorporating a cavity containing air at atmospheric pressure. The shape of the cavity is decided initially by thermal insulation considerations but this has to be modified and its location in the block chosen after a stress analysis, so that high values of vertical strength divided by effective horizontal conductivity can be achieved.

**21778 Electric pipe heater.** Protze, K.H. (to Eltra K.G. Leicht und Trambauer). German(FRG) Patent 2,453,243/C/. 21 Apr 1977. 5p. (In German).

The invention deals with a U-shaped bent electric space heater for convection heating of a medium flowing across the pipe axis with a heat-conducting profile body attached to the pipe heater. To avoid a large flow resistance, the profile body is constructed in streamline shape in the flow direction. Thus the surface expansion necessary for a good heat emission is simultaneously obtained. The system can be cheaply made with small expenditure by a suitable construction.

**21779 Cutting fuel costs.** Thorne, J.G.M. *Processing;* **23**: No. 4, 63(Apr 1977).

The fuel conservation potential of using energy managers to perform energy audits and to recommend energy conservation measures is discussed. (LCL)

**21780 Installation permitting the recuperation of heat from waste water and the saving of water.** Anderl, L. German(FRG) Patent 2,533,759/A/. 17 Feb 1977. 7p. (In German).

Hot and cold water emanating from a process such as a bank of washing machines is stored in a hot water and a cold water tank respectively. The hot water is filtered, passed through heat exchangers, then discharged. The cold water is filtered and re-used as such or passed through the heat exchangers as a pre-heating prior to reuse in the process. A four way valve controls the flow of hot and cold water through the heat exchangers as well as the rinsing of these. In a particular application the system led to 80% savings on heating costs and 50% on water use.

**21781 Significance of the non-azeotropic binary refrigerants, when used in heat pumps and refrigeration plants.** Kruse, H.; Jakobs, R. (Tech Univ, Hannover, Ger). *Klima Kaelte Ing.;* **5**: No. 7-8, 253-260(1977). (In German).

In the past non-azeotropic binary refrigerants were frequently proposed for use in refrigeration plants on account of their favorable qualities regarding energy economy, performance control and bridging of wide temperature ranges. Up to now, however, no headway for industrial use was made, because these aspects were not prevalent for the exclusive methods of refrigeration by the traditional compression refrigeration cycles. For the heat pumps, however, peak energy economy and heat control are important factors for successful competition with the traditional heating methods. It is demonstrated that non-azeotropic refrigerant mixtures provide considerable advantages for heat pump application in this direction. For this reason it is proposed to give specially careful consideration to such mixtures, when using heat pump installations.

**21782 Analysis of energy demands of air-conditioning systems.** Legg, R.C. (Inst of Environ Sci and Technol, Polytech of the South Bank, London, Engl). *Heat. Vent. Eng. J. Air Cond.;* **51**: No. 600, 6-12, 14(1977).

The principles upon which the energy demands of air conditioning plants may be calculated are illustrated by an analysis of the 100% outside air, recirculation and dual duct systems. Tables presented summarize the average hourly energy demands for the systems analyzed. 11 refs.

**21783 Conservation of energy through state action.** Swidler, J.C. (New York State Public Service Commission, Albany). pp 151-159 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

The need for energy conservation in general, and, specifically, the energy conservation potential of improved building design, construction and operation are discussed. Future shortages of energy supplies are forecast. The effects of voluntary energy conservation programs, economic incentives for more energy efficient appliances and buildings and the New York State program for legislation and executive action to promote energy conservation are described. (LCL)

## RESIDENTIAL BUILDINGS

*REFER ALSO TO CITATION(S) 21352, 21353, 21709*

**21784** (COO/2789—1) **Feedback as a means of decreasing residential energy consumption. Report PU/CES 34.** Seligman, C.; Darley, J.M. (Princeton Univ., N.J. (USA). Center for Environmental Studies). Aug 1976. Contract EY-76-S-02-2789. 26p. Dep. NTIS, PC A02/MF A01.

When residential units are analyzed in human factor terms, it is apparent that the consumption level feedback (typically a bill, calculated once a month, over all appliances) is inadequate to give the resident useful information about his energy consuming actions. The present study tested the hypothesis that providing immediate feedback to homeowners concerning their daily rate of electric usage would be effective in reducing electric consumption. In the studied homes, central air-conditioning is the largest single source of electric power consumption during the summer. Accordingly, it was possible to predict the household's expected electric consumption in terms of the average daily outdoor temperature. Predicted electric consumption was derived from a previous month's modeling period during which a regression line was fitted to predict consumption from average daily temperature, for each home. Feedback was expressed as a percentage of actual consumption over predicted consumption. Feedback was displayed to homeowners four times a week for approximately one month. The results confirmed the prediction. Before feedback began, the feedback and control groups were consuming electricity at approximately equal rates. During the feedback period, the feedback group used 10.5 percent less electricity. The effectiveness of the feedback procedure was explained in terms of its cueing, motivational, and commitment functions.

**21785** (PB—269847) **Retrofitting an existing wood frame residence for energy conservation: an experimental study. Final report.** Burch, D.M.; Hunt, C.M. (National Bureau of Standards, Washing-

ton, D.C. (USA)). Jul 1977. 160p. (NBSIR—77-1274). NTIS PC A08/MF A01.

A wood-frame residence having only limited insulation in the attic was retrofitted in three stages to reduce its energy requirements for heating and cooling. The three retrofit stages comprised: reducing air leaks; adding storm windows; and installing insulation in the floor, ceiling, and walls. The house was extensively instrumented to evaluate energy savings and other performance factors. An economic model was used to evaluate the cost effectiveness of the retrofit options and the number of years to pay back their initial investment.

**21786 Lowering heat consumption by means of infrared mirror coating of windows, facades and roofs.** Kaelin, R.; Kneubuehl, F. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik). *Gesund.-Ing.;* **98**: No. 9, 244-251(Sep 1977). (In German).

Thermal radiation losses in connection with building surfaces con result in the outer wall temperatures being lower than the ambient temperature in clear winter nights. On the basis of this phenomenon, the influence of thermal radiation losses on the heat consumption of standard building types at night was investigated. The results of these investigations are that infrared mirror coating of building surfaces can save 2 to 15% of heating energy in average altitudes.

**21787 Technical and economical aspects of the LNG market.** Zeller, H. (Linde A.G., Hoellriegelskreuth/Muenchen (Germany, F.R.). Werksgruppe Tieftemperatur und Verfahrenstechnik). *Erdoel Kohle, Erdgas, Petrochem. Brennst.-Chem.;* **30**: No. 8, 361-363(Aug 1977). (In German).

Natural gas plays a significant role as an energy and chemical raw material. Transport problems have to be solved in order to ensure supply. Depending upon the location of the source and consumer the gas will be transported either by pipeline or with tankers as LNG. Technical facilities are being established. While establishing the supply projects the economic factors and the requirements in future should be carefully studied. Special attention should be paid to the development of the gas price.

**21788 Lowering the electricity consumption of the larger domestic electric appliances.** Stoy, B.; Kionka, U. (Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt. Anwendungstechnik). *Energiewirtsch. Tagesfragen;* **27**: No. 7, 487-504(Jul 1977). (In German).

The aim of the article is to demonstrate that it is possible, while maintaining or raising the standard of living, to achieve a lower growth in electricity consumption by choosing domestic electric appliances of the larger order with the smallest specific electricity consumption possible. The reason why energy conservation efforts concentrate on the domestic sphere is that in this field the share in electricity consumption has been constantly rising. Numerical data on the energy consumption of ovens, hot water tanks, washing machines, driers, dish washers, and refrigerators are presented. The data are taken from investigation reports of the Pruefgemeinschaft der Elektrizitaetswerke.

**21789 Prefabricated houses with indoor swimming pool heated by heat pump.** Rennebeck, K. *Elektrowaerme Int., Ed. A;* **35**: No. 4, 206-211(Jul 1977). (In German).

A heating system for use in industrially prefabricated houses is described. Design and dimensioning of the heat pump and the large-surface radiators are discussed with reference to an installation that is already in operation. The basic design factors and other information are outlined. Diagrams used to determine performance data show how this new approach was arrived at. As heat pumps constitute frigorific components, the Carnot cycle is shown using the Molier-h, lg p diagrams and the performance coefficient of the heat pump determined with the aid of the performance curves of the hermitically sealed compressor.

**21790 Influence of ventilation on the optimal thermal protection and thermal comfort of dwellings.** Kunze, W.; Petzold, K. (Tech Univ, Dresden, E Ger). *Klima Kaelte Ing.;* **5**: No. 7-8, 239-242(1977). (In German).

The equation used up to now for the optimal thermal resistance of the structure in dwellings, which was accepted to be valid under the assumption of being uninfluenced by the thermal ventilation flow, is being rectified by a method of approximation which takes the thermal ventilation flow into account, and therefore is applicable to all types of buildings. With this method the assessments of the critical heating temperature and of the heating period show divergence of values from one another for internal and external positions of apartments in buildings. Applying optimal values for k (in English speaking countries for U) the deviations can be greatly reduced and the operating conditions of the heating installations and the thermal comfort of the dwellings improved. A comparison of the thermal energy consumption indicates considerable savings and proves that the thermal ventilation flow has the maximum influence on the actual heat consumption.

**21791 Comparison concerning thermal insulation installed at a later stage.** Balkowski, F.D. *Kunstst. Bau;* **11**: No. 4, 9-10(1976). (In German).

The chemical plant Huels had the opportunity to make a comparison when one of two annexed multi-family houses in Marl belonging to the firm itself, had additional thermal insulation put in. New PVC windows were installed and additional thermal insulation was fixed to the outer surface of the outer walls. Construction-physical values are presented in two comparative tables.

**21792 Heat recovery from domestic waste water.** Braeunlich, G.; Schoeffel, H. (Brown, Boveri und Cie A.G., Mannheim (Germany, F.R.)). *HLH, Z. Heiz., Lueftung, Klim., Haustech.;* **26**: No. 12, 425-430(1975). (In German).

By recovering the heat from domestic waste water with the aid of heat pumps, the energy requirements needed for making hot water could be lowered. The authors present in their contribution plant design, and they report on possible savings on energy and costs. They conclude that a heat recovery plant with heat pump could achieve an energy reduction of 50% in a 10-family house, and up to 60% in bigger dwellings.

## SCHOOL, MUNICIPAL AND OTHER PUBLIC BUILDINGS

**21793** (FEA/D—76/229(Vol.1)) **Energy conservation on campus. Volume I. Guidelines.** (Association of Physical Plant Administrators of Universities and Colleges, Washington, D.C. (USA)). Dec 1976. 38p. Dep. NTIS, PC A03/MF A01.

The Federal Government has developed a variety of programs through the Federal Energy Administration to foster large energy savings in the areas of building construction, maintenance, and operation. This publication has been prepared to assist colleges and universities and other non-profit institutions to mount and sustain effective energy management programs. The guidelines presented are the result of an extensive analysis of existing energy management programs augmented by administrative and technical expertise drawn from numerous resources. Information is included on the development of a campus energy conservation program and its implementation by minor and/or extensive changes in the design and operation of energy consuming equipment on campuses. (LCL)

**21794 Combined heat recovery system in an indoor swimming pool of a school.** Doerk, H. *Elektrowaerme Int., Ed. A;* **35**: No. 4, 202-205(Jul 1977). (In German).

Indoor swimming pools are ideally suited to the recovery of heat in order to reduce energy requirements and costs. The article deals with the heating, dehumidification and ventilation of an indoor swimming pool using a system in which heat pumps and plate heat exchangers of compact design are combined for heat recovery.

**21795 Energy management in modern hospitals.** Kalus, D.; Schemkes, W. *Elektrowaerme Int., Ed. A;* **35**: No. 3, 113-118(Mar 1977). (In German).

Hospitals are energy-intensive buildings and measures aimed at making efficient use of energy are therefore extremely important there. In one particular instance, engineers succeeded in reducing the energy consumption by about 33% compared with that of conventional systems. this was achieved without any appreciable extra expenditure since the refrigerating machine had to be provided anyway as the basic type of a heat pump recovering heat from the environment. Further savings would be possible but this would involve additional equipment.

**21796 Air-conditioning systems in hospitals.** Schmitz, H.; Mathew, A. *Elektrowaerme Int., Ed. A;* **35**: No. 3, 151-158(Mar 1977). (In German).

In addition to mere heating, hospitals require air-conditioning in many areas to maintain a specific environment. Owing to the special conditions prevailing in hospitals, such air-conditioning systems must meet exacting requirements which are specified in German DIN standard 1946, sheet 4, entitled "Ventilation in Hospitals". The extensive revision of this standard which was issued in June 1974 imposes exacting requirements. The spread of bacterial hospitalism must be largely eliminated and efforts must therefore be concentrated on avoiding contamination of the outside air, and air recirculation, and the spread of infectants by undesired air flows, the control of ducting with provision for inspection and cleaning and efficient filtration. As recirculation of the air is not allowed, it is urgently necessary provide for heat recovery and to make optimum use of the energy available. Cooperation between architect and engineer is of particular importance to ensure that the design of the building is fully adapted to the air-conditioning requirements.

## COMMERCIAL AND INDUSTRIAL BUILDINGS

**21797** (PB—269906) **State-of-the-art of functional use data measuring energy consumption in the commercial sector. Final report.** Kaufman, H.A.; Anderson, W. (Faucett (Jack) Associates, Inc.,

Chevy Chase, Md. (USA)). Apr 1977. Contract FEA-P-03-77-4390-0. 82p. (JACKFAU—77-173-1). NTIS PC A05/MF A01.

The purpose of the study was to develop estimates of the amount of energy consumed in 1974 for each of the six functional uses in eight commercial industries. The report is an attempt to shed additional light on the methodology used in a previous study to estimate the overall energy consumption and to document the availability of information concerning functional use patterns of energy consumption.

## TRANSPORTATION

**21798** (PB—270068) **Energy efficiency improvement target transportation equipment industry (SIC 37). Volume 1.** (Kearney (A.T.), Inc., Chicago, Ill. (USA)). 12 Jul 1976. Contract FEA-CR-04-60612. 430p. NTIS PC A19/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States. This proposed target is based on the best available information and is established at the level which represents the maximum feasible improvement in energy efficiency that the Transportation Equipment Industry (Standard Industrial Classification 37) can achieve by January 1, 1980, taking into account considerations of the technological feasibility and economic practicability of using alternative operating procedures and more energy efficient technologies. The draft target represents the percentage reduction in energy consumed per unit of output or activity that can be achieved between calendar year 1972 and January 1, 1980.

**21799** (PB—270069) **Energy efficiency improvement targets for the transportation equipment industry (SIC 37). Volume 2. Industrial programs, conservation and environment. Target support document.** (Kearney (A.T.), Inc., Chicago, Ill. (USA)). 12 Jul 1977. Contract FEA-CR-04-60612. 259p. NTIS PC A12/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States. This proposed target is based on the best available information and is established at the level which represents the maximum feasible improvement in energy efficiency that the Transportation Equipment Industry (Standard Industrial Classification 37) can achieve by January 1, 1980, taking into account considerations of the technological feasibility and economic practicability of using alternative operating procedures and more energy efficient technologies. The draft target represents the percentage reduction in energy consumed per unit of output or activity that can be achieved between calendar year 1972 and January 1, 1980.

**21800** (PB—270070) **Energy efficiency improvement targets for the transportation equipment industry(SIC 37). Volume 3. Final target document.** (Kearney (A.T.), Inc., Chicago, Ill. (USA)). Jan 1977. Contract FEA-CR-04-60612. 134p. NTIS PC A07/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States, and invited the oral and written presentation of views thereon by interested persons. Following public hearings and review of the written comments which were submitted to FEA, the final targets for Transportation Equipment (Standard Industrial Classification 37) have been developed and are described in this report.

### AIR AND AEROSPACE

*REFER ALSO TO CITATION(S) 21633*

**21801** (N—77-27020) **Factors affecting the corporate decision making process of air transport manufacturers. Final report.** Ollila, R.G.; Hill, J.D.; Noton, B.R.; Duffy, M.A.; Epstein, M.M. (Battelle Columbus Labs., Ohio (USA)). 15 Dec 1976. Contract NASW-2970. 118p. (NASA-CR—154618). NTIS PC A06/MF A01.

Fuel economy is a pivotal question influencing the future sale and utilization of commercial aircraft. The NASA Aircraft Energy Efficiency (ACEE) Program Office has a program intended to accelerate the readiness of advanced technologies for energy efficient aircraft. Because the decision to develop a new airframe or engine is a major financial hazard for manufacturers, it is important to know what factors influence the decision making process. A method is described for identifying and ranking individuals and organizations involved at each stage of commercial air transport development, and the barriers that must be overcome in adopting new technologies.

### RAILWAY

**21802** **Freight car management systems: a new way out of the car utilization dilemma.** Shamberger, R.C. (Federal Railroad Administration, Washington, DC). pp 559-560 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Fourth generation computers allow for a great deal of exploitation by the railroad industry. Capabilities exist for the computer to take on a role of virtually operating the railroad and executing a new philosophy of operation which addresses and emphasizes service reliability and car utilization. Management relationships and roles must change also; but in today's climate of impending financial collapse there is a new way out of the car utilization dilemma.

### LAND AND ROADWAY

**21803** (PB—269746) **Energy conservation competes with regulatory objectives for truckers: Interstate Commerce Commission. Report to the Congress.** (General Accounting Office, Washington, D.C. (USA). Community and Economic Development Div.). 8 Jul 1977. 59p. (CED—77-79). NTIS PC A04/MF A01.

This report describes how the Interstate Commerce Commission can improve its actions to reduce energy use for trucks. It also discusses problems relating to reducing energy use and how the Commission, within its statutory authority, has attempted to solve these problems.

**21804** (PB—270025) **Uncertainties in estimates of fleet average fuel economy: a statistical evaluation. Final report November 1975—November 1976.** Rabe, F.T. (Environmental Impact Center, Inc., Newton, Mass. (USA)). Jun 1977. Contract DOT-TSC-1311. 63p. NTIS PC A04/MF A01.

Research was performed to assess the current Federal procedure for estimating the average fuel economy of each automobile manufacturer's new car fleet. Test vehicle selection and fuel economy estimation methods were characterized statistically and sources of uncertainty identified.

**21805** **Second generation computer control procedures for dial-a-ride.** Wilson, N.H.M. (Massachusetts Inst. of Tech., Cambridge). pp 547-552 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Based on operational experience with initial computer control procedures, more sophisticated procedures have been developed designed to provide a greater variety of services simultaneously and to allow the operator more discretion in the quality of service provided. These second generation control procedures and analyses, their effectiveness in the light of previous operational experience, and in a simulation context are described.

**21806** **Flow-coordinated operating strategies for automated transportation systems.** Kiselewich, S.J.; Tong, Y.M.; Morse, A.S. (Yale Univ., New Haven, CT). pp 553-558 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

A Personalized Automated Transportation (PAT) system consists fundamentally of a set of stations interconnected by means of a network of dedicated guideways on which personalized vehicles travel under computer control. Such systems are intended to provide users with either scheduled or demand responsive service from station of origin to station of destination. The main components of two alternative flow-coordinated strategies upon which an overall vehicle management problem might be based are outlined, and the simulation procedures discussed. Within this framework there remains a large number of unresolved problems, each involving interesting theoretical questions of practical importance.

### PIPELINE

*REFER ALSO TO CITATION(S) 21096*

## INDUSTRY AND AGRICULTURE

*REFER ALSO TO CITATION(S) 21698, 21699, 21700, 21779*

## ENERGY SOURCES

*REFER ALSO TO CITATION(S) 20924, 20931, 21716, 21718, 21719, 21724, 22084*

**21807** (CONF-770658—, pp 3-14) **Coal firing technology for existing side fired tunnel kilns.** Sells, G.C. (General Shale Products Corp., Johnson City, TN). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

The design and operation of a solid fuel metering and delivering system for coal fired tunnel kilns is described. The system is designed for use with +14 to -200 mesh coal that burns in suspension. A schematic of the system is included along with cost information. (JRD)

**21808** (CONF-770658—, pp 15-28) **Experiences in direct firing of glass furnaces, Columbine Glass.** Sheehan, D.R. (Tusco Engineering Co., Inc., Commerce City, CO). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Operation of a glass production unit using pulverized coal fuel is described. Diagrams and slides show operation of the unit melter, the end port regenerative furnace, the side port regenerative furnace, and the end port regenerative amber glass furnace. (JRD)

**21809** (CONF-770658—, pp 53-65) **Blast furnace coal injection at Armco's Ashland Works.** Garbee, A.K. (ARMCO Steel Corp., Middletown, OH). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Systems for injecting pulverized coal into iron blast furnaces at Armco are described. The infection systems used at the Bellefonte furnace and the Amanda furnace are presented using flowsheets and schematics. Data on injection coal are included. (JRD)

**21810** (CONF-770658—, pp 149-176) **Principal aspects of converting steam generators back to coal.** Heil, T.J.; Leatham, C.H. Jr. (Gilbert Commonwealth Associates, Inc., Jackson, MI). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Aspects of converting oil or gas-fired steam generators to coal are discussed in sections on coal mining and transporting, coal handling and storage, proper burning equipment, pollution control, and ash disposal. Data on fuel costs are included along with schematics of coal handling systems. (JRD)

**21811** (CONF-770658—, pp 177-186) **Experiences in tunnel-kiln coal firing and related pollution control.** Auger, W. (Globe Refractories, Inc., Newell, WV). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

The use of pulverized coal to fire tunnel kilns is discussed. Development of a pulverized coal firing system is described along with problems associated with coal distribution to burners, coal particle size, and fly ash removal from the kiln. Air pollution control systems are described. (JRD)

**21812** (CONF-770658—, pp 223-248) **Industry capability to supply equipment.** Marx, W.B. (American Boiler Manufacturers Association, Arlington, VA). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Aspects of coal-fired boiler production and design are discussed along with problems associated with converting gas or oil-fired boilers to coal. Data are included on available industrial fuels, coal firing of industrial boilers, and coal-designed units built. (JRD)

**21813** (PB—269365) **Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text.** Brickhill, J.A. (Foster Associates, Inc., Washington, D.C. (USA). Energy Div.). Mar 1977. Contract EPA-68-02-1452. 138p. NTIS PC A07/MF A01.

This study was conducted to analyze the impact of natural gas shortages on major fuel-burning installations. The analysis estimated the availability of natural gas through 1980 for major fuel-burning installations, the alternate fuel-burning capability of these plants, the need for alternate fuels such as fuel oil and coal to offset the gas shortages and the estimated increase in sulfur dioxide and particulate emissions from the burning of these alternate fuels. The study results are presented in a three volume report: Volume 1 contains the narrative for the analysis of natural gas shortages on the gas-fired plants with pertinent findings and conclusions.

**21814** (PB—269366) **Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables).** Brickhill, J.A. (Foster Associates, Inc., Washington, D.C. (USA). Energy Div.). Mar 1977. Contract EPA-68-02-1452. 95p. NTIS PC A05/MF A01.

This study was conducted to analyze the impact of natural gas shortages on major fuel-burning installations. The analysis consisted of the review of gas curtailments plans, natural gas supplies, FEA survey data for MFBI and applicable state air-pollution-control regulations. Volume 2 contains edules of data summaries for the natural-gas-fired plants.

**21815** (PB—269367) **Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS.** Brickhill, J.A. (Foster Associates, Inc., Washington, D.C. (USA). Energy Div.). Mar 1977. Contract EPA-68-02-1452. 91p.

This study was conducted to analyze the impact of natural gas shortages on major fuel-burning installations. The analysis consisted of the review of gas curtailments plans, natural gas supplies, FEA survey data for MFBI and applicable state air pollution control regulations. Volume 3 presents a limited analysis of all the MFBI data.

## MATERIALS

**21816** **Economics of energy and materials.** Alexander, W.O. (Univ of Aston, Birmingham, Engl). *Mater. Sci. Eng.;* **29**: No. 3, 195-203(Aug 1977).

This view of materials for engineering and structural applications looks at metals, plastics, other nonmetals such as concrete and timber, and evaluates likely developments in the light of the current situation and visible trends. Among the points covered are consumption patterns in the United States, price trends, techno-economic relationships of strength-rigidity and of conductivity, considerations of total energy content, recycling and others.

## EQUIPMENT AND PROCESSES

*REFER ALSO TO CITATION(S) 20984, 21716, 21781, 21839*

**21817** (PB—269819) **Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 1. Draft target support document.** (Ford, Bacon and Davis, Inc., New York (USA)). Sep 1976. Contract FEA-CR-04-60605. 137p. NTIS PC A07/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States. This proposed target is based on the best available information and is established at the level which represents the maximum feasible improvement in energy efficiency that the Paper and Allied Products Industry (Standard Industrial Classification 26) can achieve by January 1, 1980, taking into account considerations of the technological, feasibility and economic practicability of utilizing alternative operating procedures and more energy efficient technologies. The draft target represents the percentage reduction in energy consumed per unit of output or activity that can be achieved between calendar year 1972 and January 1, 1980.

**21818** (PB—269820) **Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 2. Appendix to draft target support document.** (Ford, Bacon and Davis, Inc., New York (USA)). Sep 1976. Contract FEA-CR-04-60605. 99p. NTIS PC A05/MF A01.

The appendix contains the detailed supporting documentation and rationale for the energy efficiency improvement goals for each of the component industries in SIC 26.

**21819** (PB—269821) **Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 3. Final target support document.** (Ford, Bacon and Davis, Inc., New York (USA)). Mar 1977. Contract FEA-CR-04-60605. 64p. NTIS PC A04/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States, and invited the oral and written presentation of views thereon by interested persons. Following public hearings and review of the written comments which were submitted to FEA, the final targets for Paper and Allied Products Industry (Standard Industrial Classification 26) have been developed and are described in this report.

**21820** (PB—269830) **Energy efficiency improvement targets. Food and kindred products industry (SIC 20). Volume 1. Draft target support document.** (Development Planning and Research Associates, Manhattan, Kans. (USA)). 30 Jun 1976. Contract FEA-CR-04-60603. 189p. NTIS PC A09/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States. This proposed target is based on the best available information and is established at the level which represents the maximum feasible improvement in energy efficiency that the Food and Kindred Products Industry (Standard Industrial Classification 20) can achieve by January 1, 1980, taking into account considerations of the technological feasibility and economic practicability of using alternative operating procedures and more energy efficient technologies. The draft target represents the percentage reduction in energy consumed per unit of output or activity that can be achieved between calendar year 1972 and January 1, 1980.

**21821** (PB—269831) **Energy efficiency improvement targets. food and kindred products industry (SIC 20). Volume 2. Appendix report. Part 1.** (Development Planning and Research Associates, Manhattan, Kans. (USA)). 30 Jun 1976. Contract FEA-CR-04-60603. 273p. NTIS PC A08/MF A01.

The appendix contains the detailed supporting documentation and rationale for the energy efficiency improvement goals for each of the component industries in SIC 20.

**21822** (PB—269832) **Energy efficiency improvement targets. Food and kindred products industry (SIC 20). Volume 3. Appendix report. Part 2.** (Development Planning and Research Associates, Manhattan, Kans. (USA)). 30 Jun 1976. Contract FEA-CR-04-60603. 289p. NTIS PC A13/MF A01.

The appendix contains the detailed supporting documentation and rationale for the energy efficiency improvement goals for each of the component industries in SIC 20.

**21823** (PB—269869) **Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 1. Draft target and support document.** (Battelle Columbus Labs., Ohio (USA)). 1 Jul 1976. Contract FEA-CR-04-60606. 233p. NTIS PC A11/MF A01.

The following topics are discussed: salient characteristics of SIC 28, chemicals and allied products)standard industrial product classification, standard industrial classification of establishments, data from the Bureau of the Census, energy data, and summary characteristics); methodology(the methodology in brief, and developing a framework); on industry results from energy conservation programs(summary and major energy conservation techniques); SIC 2812, alkalies and chlorine; SIC 2813, industrial gases; SIC 2816, inorganic pigments; SIC 2819, industrial inorganic chemicals, n.e.c.; SIC 2821, plastic materials, synthetic resins, and nonvulcanizable elastomers; SIC 2822, synthetic rubber; SIC 2823, cellulosic man-made fibers; SIC 2824, synthetic organic fibers, except cellulosic; SIC 283, drugs; SIC 284, soaps, detergents and cleaning preparations, perfumes, cosmetics, and other toilet preparations; SIC 2851, paints, varnishes, lacquers, enamels, and allied products; SIC 2861, gum and wood chemicals; SIC 2865, cyclic (coal tar) crudes, and cyclic intermediates, dyes and organic pigments (lakes and toners); SIC 2869, industrial organic chemicals, n.e.c.; SIC 2873, nitrogenous fertilizers; SIC 2874, phosphatic fertilizers; SIC 2875, fertilizers, mixing only; SIC 2879, pesticides and agricultural chemicals, n.e.c.; SIC 2891, adhesives and sealants; SIC 2982, explosives; SIC 2893, printing ink; SIC 2895, carbon black; SIC 2899, chemicals and chemical preparations, n.e.c.; estimation of target for SIC 28(analysis using bridge matrix, goals and target on an establishment basis, and sensitivity analyses and assessment of validity of data); and continuing work.

**21824** (PB—269870) **Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 2. Appendixes Part 1. Draft target and support document.** (Battelle Columbus Labs., Ohio (USA)). 1 Jul 1976. Contract FEA-CR-04-60606. 285p. NTIS PC A13/MF A01.

This is part 1 of the appendix that contains the detailed supporting documentation and rationale for the energy efficiency improvement goals for each of the component industries in SIC 28.

**21825** (PB—269871) **Developing a maximum energy efficiency improvement target for sic 28: chemicals and allied products. Volume 3. Appendixes part 2. Draft target and support document.** (Battelle Columbus Labs., Ohio (USA)). 1 Jul 1976. Contract FEA-CR-04-60606. 244p.

This is part 2 of the appendix that contains the detailed supporting documentation and rationale for the energy efficiency improvement goals for each of the component industries in SIC 28.

**21826** (PB—269872) **Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 4. Revisions and addenda. Draft target and support document.** (Battelle Columbus Labs., Ohio (USA)). 1 Jul 1976. Contract FEA-CR-04-60606. 173p. NTIS PC A08/MF A01.

The following topics are discussed; revisions(SIC 2812, alkalies and chlorine, SIC 2819, industrial inorganic chemicals, n.e.c., SIC 2821, plastics materials, Synthetic resins, and nonvulcanizable elastomers, SIC 2865, cyclic (coal tar) crudes, and cyclic intermediates, dyes, and organic pigments and toners, and SIC 2869, industrial organic chemicals, not elsewhere classified); and addenda(technical and economic practicability, manufacturing ammonia, and manufacturing ethelene).

**21827** (PB—269873) **Developing a maximum energy efficiency target for SIC 28: chemicals and allied products. Volume 5. Further revisions. Draft target and support document.** (Battelle Columbus Labs., Ohio (USA)). 1 Jul 1976. Contract FEA-CR-04-60606. 51p. NTIS PC A04/MF A01.

This volume contains revisions for the first volume on the following chemical industries: Synthetic rubbers, cellulosic man-made fibers, and synthetic fibers except cellulosic fibers.

**21828** (PB—269874) **Developing a maximum energy efficiency target for SIC 28: chemicals and allied products. Volume 6.** (Battelle Columbus Labs., Ohio (USA)). 4 Mar 1977. Contract FEA-CR-04-60606. 50p. NTIS PC A03/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), Pub. L. 94-163, the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States, and invited the oral and written presentation of views thereon by interested persons (41 FR 48169, November 2, 1976). Following public hearings and review of the written comments which were submitted to FEA, the final targets for Chemical and Allied Products (Standard Industrial Classification 28) have been developed and are described in this report. They are intended to provide the basis for conservation activities undertaken in furtherance of the industrial energy conservation program.

**21829** (PB—269887) **Energy efficiency improvement targets in the machinery (except electrical) industry, SIC 35. Industrial programs conservation and environment. Volume I.** (Kearney (A.T.), Inc., Chicago, Ill. (USA)). 12 Jul 1976. Contract FEA-CR-04-60611. 265p. NTIS PC A12/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States. This proposed target is based on the best available information and is established at the level which represents the maximum feasible improvement in energy efficiency that the Machinery (except Electrical) Industry (Standard Industrial Classification 35) can achieve by January 1, 1980, taking into account considerations of the technological feasibility and economic practicability of using alternative operating procedures and more energy efficient technologies. The draft target represents the percentage reduction in energy consumed per unit of output or activity that can be achieved between calendar year 1972 and January 1, 1980.

**21830** (PB—269888) **Energy efficiency improvement targets in the machinery (except electrical) industry, SIC 35. Volume 2. Target support document.** (Kearney (A.T.), Inc., Chicago, Ill. (USA)). 12 Jul 1976. Contract FEA-CR-04-60611. 621p. NTIS PC A99/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States. This proposed target is based on the best available information and is established at the level which represents the maximum feasible improvement in energy efficiency that the Machinery (except Electrical) (Standard Industrial Classification 35) can achieve by January 1, 1980, taking into account considerations of the technological feasibility and economic practicability of using alternative operating procedures and more energy efficient technologies. The draft target represents the percentage reduction in energy consumed per unit of output or activity that can be achieved between calendar year 1972 and January 1, 1980.

**21831** (PB—269889) **Energy efficiency improvement targets in machinery (except electrical) industry, SIC 35. Volume 3. Final target document.** (Kearney (A.T.), Inc., Chicago, Ill. (USA)). Jan 1977. Contract FEA-CR-04-60611. 134p. NTIS PC A07/MF A01.

In accordance with section 374 of the Energy Policy and Conservation Act (EPCA), the Federal Energy Administration (FEA) proposed industrial energy efficiency improvement targets for the ten most energy-consumptive manufacturing industries in the United States, and invited the oral and written presentation of views thereon by interested persons. Following public hearings and review

of the written comments which were submitted to FEA, the final targets for Machinery (except Electrical) (Standard Industrial Classification 35) were developed and are described in this report.

**21832 How to decrease the energy demand of powder metallurgy furnaces.** Tamalet, M. (Heurtey Metall, Paris, Fr). *Powder Metall. Int.;* **9**: No. 3, 119-120, 125-126(Aug 1977).

The sintering operation in powder metallurgy requires an extensive energy consumption, which it is possible to reduce considerably by improving the furnace efficiency. Atmosphere gas represents the highest consumption item. Improving the handling devices allows for increasing each furnace load, reducing the dead weights and improving efficiency. Taking special care of the furnace insulation avoids important losses. The improvements item by item are summarized in the optimized performance figures of a belt furnace. 6 refs.

**21833 Energy profile and reduction of specific energy consumption in foundries.** Ulmer, G. (Cent Tech des Ind de la Fonderie, Fr). *Fonderie;* **32**: No. 369, 219-236(Jul 1977). (In French).

Recent statistical data on fuel economy in foundries are analyzed, and potential energy savings are examined. Rules are presented for reducing specific thermal energy consumption in foundry operations, and examples are given of energy economizing operations. Capital investments contributing to energy economy are discussed.

**21834 Energy saving: system to limit and optimize power consumption in process technology.** *Verfahrenstechnik (Mainz);* **11**: No. 7, 409(Jul 1977). (In German).

The "TORRA" control system is described. Operation of a computer with printer, and of the machine controls is analyzed. Economies of 1 megawatt are achieved by eliminating peaks.

**21835 Electric purification of gases.** Joffre, R. (Soc LURGI, Fr). *Rev. Gen. Electr.;* **86**: No. 6, 521-529(Jun 1977). (In French).

The operation of an electroprecipitator is based on the ionization of gases due to the corona effect provoked by an electric field between two electrodes. Dust particle or chemical impurities are charged negatively and shifted towards the positive electrode where they are discharged. Gas purification is based essentially on the Deutsch formula which shows that filtering efficiency varies exponentially in terms of the gas output and the area of the collecting electrodes. The two major values are the migration speed of gases (which varies in terms of a great number of factors) and dust resistivty (which takes account of gas temperature and moisture). To design an electroprecipitator one has to determine some parameters, the major ones are the output, the gas temperature, the dust content both at the inlet outlet, dust resistivity, gas velocity, migration speed and gas flow section, then the precipitating area, sparking distance and migration time of the particles in the electroprecipitator and, finally, ionization voltage and current density.

**21836 Radio frequency drying of papers and textiles.** Jones, P.L.; Hodgett, D.; Lawton, J. (Electr Counc Res Cent, Capenhurst, Engl). *Elektrowaerme Int., Ed. B;* **35**: No. 3, 142-146(Jun 1977).

Work done by the Electricity Council Research Center on the application of high frequency heating techniques and the relative merits of radio frequency (27.12 MHz) and microwave (896 and 2450 MHz) are considered and compared under practical conditions. The results of detailed investigations, particularly the drying of paper and textiles, are discussed and the economics are shown to be advantageous in situations where conventional drying systems cease to operate efficiently. Specimen calculations are given showing that up to 19% of the energy required for drying paper can be saved by installing a radio frequency heating unit in the correct position on a paper machine.

**21837 Present position of electron beam melting and casting technology.** Stephan, H. *Elektrowaerme Int., Ed. B;* **35**: No. 3, 150-153(Jun 1977).

The paper reports about the process in building of EB melting and casting furnaces for different specific applications. A small 10 kW EB melting and spincasting furnace is applied for refining of a special plutonium isotope for alloying and homogenization, using a rolling droplet in a swinging crucible and, in the last stage, spincasting of thin Pu-rodlets for the production of heart pacer batteries. A high production titanium casting furnace for the annual production of 1,200 cast-parts of an average weight of 60 kg each is described. The furnace is fully automated and allows the production of castings between 10 and 100 kg/weight. The maximum furnace power is 600 kW and is provided by two electron beam guns. In the third section a fully automated, computer-controlled EB Casting Furnace is described. The cycle time is between 60 and 120 s for castings of 500 to 2,500 g. The special performance of that furnace is the accuracy of the pouring temperature of $<1\%$, the accuracy of the casting weight of 3% and the continuous running time of 50 h with one furnace load. The last chapter describes a 1200 kW melting furnace for the production of 400 mm dia and 2.5 t niobium and tantalum-ingots of highest purity.

**21838 Assessment of current practice with regard to charge preheating in electrometallurgy.** Piotrowska, E.; Michalowski, M. (Politech Slaska, Katowice, Pol). *Hutnik (Katowice);* **44**: No. 7/8, 359-366(1977). (In Polish).

Electric arc steelmaking furnaces consume large quantities of energy in the preheating and melting of the charge. The electric power required for this purpose can be replaced by cheaper power obtained by burning gaseous or liquid fuels. If the metal charge is preheated outside the electric furnace in a charging facility especially adapted for this purpose, not only is it possible to save electric power, but the output of the furnace is increased.

## WASTE HEAT RECOVERY AND UTILIZATION

*REFER ALSO TO CITATION(S) 21517, 21706*

**21839** (DOE-tr—45) **[Energy conservation methods used in French industry].** 1977. Translation: source information not available. 71p. Dep. NTIS, PC A04/MF A01.

Seventy-one energy conservation operations used in French industrial processes and in residences are documented with separate single paragraph summaries. Information is included on waste heat utilization for industrial drying, space heating, and water heating, use of heat pumps, thermal insulation for buildings, solar heating, use of liquid and solid wastes as fuels, methane production from municipal waste processing and methane storage, and heat recovery equipment. (LCL)

## INDUSTRIAL WASTE MANAGEMENT

**21840** (BMFT-FB-T—77-08) **Sludge from paper production. Final report. Recycling of industrial wastes. Phase II.** Zyla, W. (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)). Jul 1975. 46p. (In German). Dep. NTIS (US Sales Only), PC A03/MF A01.

The dumping of paper sludge from paper production can be avoided by means of a technique proposed by Dornier System and tested successfully in cooperation with relevant branches of industry. Thus it proved possible to recycle almost the entire paper sludge of 45,000 tons/yr resulting from paper production in the model region of North Wuerttemberg/North Baden by re-using it for cardboard production. Besides the decrease in dump volumes, appreciable savings were realized both by the originator and the user of the waste product.

**21841** (PB—270085) **Single cell protein and other food recovery technologies from waste. Final report March—September 1976.** Ware, S.A. (Ebon Research Systems, Silver Spring, Md. (USA)). May 1977. Contract EPA-68-03-2395. 145p. NTIS PC A07/MF A01.

Current research into methods of solid waste management is focusing on formation of marketable products to defray the costs of treatment prior to land disposal. Some wastes are already being commercially exploited for their energy value. It is also possible to produce a food or feed through a number of technologies including single cell protein production, enzyme hydrolysis, anaerobic digestion, and various methods to improve the digestibility and acceptability of cellulose wastes. This report examines the technological, economic and environmental feasibility of the above processes. Single cell protein production from wastes is compared to SCP production on other substrates (alcohols, alkanes, etc.) and to conventional methods of farming.

**21842 Waste burner overfire draft system.** Kahlert, G.; Pommer, L.; Davis, J.; Whebell, B. (to Northwood Pulp and Timber Ltd.). US Patent 4,059,061. 22 Nov 1977. Filed date 3 Dec 1975. 12p.

An overfire draft system for a waste burner is disclosed. Such system comprises air vents arranged circumferentially around the base of the burner for communicating the interior of the burner to the atmosphere and a draft modulated damper plate located in each air vent for automatically regulating the volume of overfire air delivered to the interior of the burner. Each draft modulated damper plate is provided with a lower lip which is deflected by a predetermined angle with respect to the plate to create an aerodynamic lift effect with large opening moment to assist the damper plate in its response under low air velocity conditions, and an oppositely deflected upper lip with proportionately less bent surface to avoid flutter or hunting of the damper as it approaches the maximum open position and to provide added dynamic opening force. The overfire draft system is also provided with ducts connected to the air vents and oriented so as to direct air tangentially around the base of the burner and toward the lower inside wall of the burner so as to minimize the disturbance of the inside air. The waste burner may also be provided with draft modulated or forced air vents arranged circumferentially at mid-elevation around the burner and duct means connected to such vents and directed at a small angle with the radius

of the burner so as to cause turbulence in the flame zone and reduce the vertical velocity of gases above the fire, thus reducing emission of particulate materials.

**21843 Positive uses of mill tailings.** Down, C.G.; Stocks, J. (Imp Coll of Sci and Technol, London, Engl). *Min. Mag.;* **137**: No. 3, 213-223(Sep 1977).

This article examines positive uses for mill tailings and tailings disposal areas, including the recovery of metals and minerals, bulkfill applications and the processing of tailings to form a useful product in its own right. Some typical examples of how tailings are upgraded into commercially usable products by different companies are given.

**21844 Phase state of ash remainders of residual fuel oil.** Sirina, T.P.; Arbuzova, N.A.; Pershina, R.F.; Arbuzov, V.A.; Krasnoselov, G.K.; Slotvinskii-Sidak, N.P.; Sidorova, G.A. (NIIM, Chelyabinsk, USSR). *Teploenergetika (Moscow);* No. 3, 38-41(Mar 1977). (In Russian).

An investigation is carried out regarding the phase state of ash remainders of residual fuel oil as a possible raw material for the extraction of vanadium and nickel. Five principal groups of compounds were found in the phase composition of samples, namely: sulfates soluble in water fully or partly; sodium-vanadium compounds; magnetic and nonmagnetic spinelides; metal oxides; compounds not containing vanadium. The phase that is richest in nickel is ferronickel spinelide. Vanadium and nickel form not only independent compounds but are included in a number of phases as isomorphous impurities. 15 refs.

**21845 Continuous fixed-film denitrification of high-strength industrial nitrate wastes.** Compere, A.L.; Griffith, W.L. (Oak Ridge National Lab., TN). *Dev. Ind. Microbiol.;* **18**: 717-722(1977).

Waste waters from the uranium fuel cycle, and the fertilizer, electronic-processing, metal-pickling, explosive, and food-processing industries may contain in excess of 1000 mg/liter of nitrate. A number of environmental and health problems, including algal blooms and methemoglobulinemia, are attributed to nitrate concentrations at levels under 100 mg/liter of nitrate. In order to reduce the high industrial waste-water concentration to acceptable levels for discharge, a fixed-film system for processing high-strength nitrate wastes has been developed and tested at a pilot scale. The system uses pall rings which have been treated with nitric acid to provide a surface charge as a bed packing for the support of a mixed microorganism culture. The system is able to treat nitrate wastes at a concentration of 0.125 M or less at loading rates ranging between 15.5 and 24 g/liter of nitrate of overall process tank volume per day. At loading rates of 33 g/liter of nitrate per day, the efficiency of the system decreases markedly.

## MUNICIPALITIES AND COMMUNITY SYSTEMS

### PUBLIC UTILITIES

*REFER ALSO TO CITATION(S) 21706, 21727*

**21846** (ANL/CES/TE—77-1) **Internal combustion piston engines.** Segaser, C.L. (Oak Ridge National Lab., Tenn. (USA)). Jul 1977. Contract W-31-109-ENG-38. 85p. Dep. NTIS, PC A05/MF A01.

Current worldwide production of internal combustion piston engines includes many diversified types of designs and a very broad range of sizes. Engine sizes range from a few horsepower in small mobile units to over 40,000 brake horsepower in large stationary and marine units. The key characteristics of internal combustion piston engines considered appropriate for use as prime movers in Integrated Community Energy Systems (ICES) are evaluated. The categories of engines considered include spark-ignition gas engines, compression-ignition oil (diesel) engines, and dual-fuel engines. The engines are evaluated with respect to full-load and part-load performance characteristics, reliability, environmental concerns, estimated 1976 cost data, and current and future status of development. The largest internal combustion piston engines manufactured in the United States range up to 13,540 rated brake horsepower. Future development efforts are anticipated to result in a 20 to 25% increase in brake horsepower without increase in or loss of weight, economy, reliability, or life expectancy, predicated on a simple extension of current development trends.

**21847** (ANL/CES/TE—77-4) **Heat recovery equipment for engines.** Segaser, C.L. (Oak Ridge National Lab., Tenn. (USA)). Apr 1977. Contract W-31-109-ENG-38. 76p. Dep. NTIS, PC A05/MF A01.

The recovery and use of waste heat from prime movers is an important consideration for evaluating an on-site power system, since it is the basic factor that makes possible a substantial increase in fuel-use efficiency. The equipment usually employed to recover waste heat can be categorized as: (a) shell-and-tube type heat exchangers, (b) radiator-type heat exchangers, (c) exhaust gas boilers for the generation of pressurized hot water and/or steam, (d) steam separators, and (e) combined packaged units for ebulliently cooled internal combustion piston engines. The functional requirements and cost considerations involved in applying these devices for the recovery of waste heat from various types of prime-movers considered for application in the ICES Systems Engineering Program are examined.

**21848** (PB—269420) **Utility rules of the Georgia Public Service Commission, effective January 1, 1976.** (Georgia Public Service Commission, Atlanta (USA)). 1976. 112p. NTIS PC A06/MF A01.

The following topics are covered: administration; practice and procedure; general rules; stocks and bonds; telegraph; telephone utilities; gas utilities; employment and use of service observing equipment furnished by a telephone company; safe installation and operation of natural gas transmission and distribution systems; Rules and regulations governing radio utilities; territorial electric assignments; telephone service; and administrative history.

**21849** (PB—269684) **State of the art for integrated Energy/Utility Systems.** (Department of Health, Education, and Welfare, Washington, D.C. (USA). Office of Facilities Engineering and Property Management). Feb 1977. 215p. NTIS PC A10/MF A01.

This is a guide to the available technology for Integrated Energy/Utility Systems for campuses, medical centers and communities. It covers in detail those matters that are involved in the technical, economic, environmental, and institutional analyses for integrated energy/utility systems.

### MUNICIPAL WASTE MANAGEMENT

*REFER ALSO TO CITATION(S) 22083*

**21850 Pollution control by incineration.** Thorne, J.G.M. *Processing;* **23**: No. 7, 34-35(Jul 1977).

The design, operation and performance of a fluidized-bed combustor for the incineration of sewage sludges are discussed. (LCL)

# ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

## INTERNAL COMBUSTION ENGINES

*REFER ALSO TO CITATION(S) 21846, 21847*

**21851 Method and device for the conversion of heat into mechanical energy.** Bailey, L.L.; Kimmel, D.R. German(FRG) Patent 2,453,616/A/. 15 May 1975. 15p. (In German).

In order to increase the total efficiency of such methods - primarily for application in vehicles - the invention proposes the use of two media, one having a high, the other a low boiling point. The fuel - preferably fluids based on petroleum - should always have the lower boiling point. It is injected into a limited expansion chamber containing a fluid with a high boiling point (e.g. lead). Thereby the fuel expands and drives the high-boiling fluid out of the chamber. The displaced high-boiling fluid is used at discharge for producing mechanical energy. The low-boiling medium is then ignited in a second chamber during supply of air. The resulting heat serves for heating the high-boiling fluid which is again fed into the circuit. Numerous claims describe the individual steps of the process and the individual elements of the machine as well as the possible variations of the latter.

### SPARK-IGNITION

*REFER ALSO TO CITATION(S) 21860*

**21852 Energy usage and other comparisons between gasoline and diesel medium duty trucks.** Jacobs, K.M. (State of Me DOT). *SAE Prepr.;* No. 770757, 1-8(12 Sep 1977).

Fuel consumption and other operating data on comparable diesel and gasoline trucks have been compiled from the records of the Maine Department of Transportation. The trucks, from the Maine highway maintenance fleet, have a GVW of approximately 24,000 pounds. Information on the use of other petroleum based products, such as engine oil and lubricants, and on required engine maintenance are given. In addition, fuel economies for the diesel and gasoline trucks by year during winter and summer operations are compared to enable consideration of seasonal effects. The data is for a four year operating period from 1972 through 1976 representing

fiscal years 1973 through 1976. In general, the diesel trucks used approximately one-third less fuel than comparable gasoline trucks.

### DIESEL

**21853** **Low compression ratio highly supercharged two-stroke engine.** Murat, M.; Flageul, J.M.; Andre-Talamon, T.; Besson, B. (Univ Paris, Fr). *Entropie;* **13**: No. 74, 62-69(1977). (In French).

Very high supercharging of low compression-rate Diesel engines both allows the mean effective pressure of the engine to be increased and its thermal load to be controlled by increasing the excess amount of air contributing to combustion. The main obstacle to the development of the two-stroke engine can thus be overcome. But the question arises of the energy balance of the compressor and the supercharging turbine, which could be upset by excessive dilution of the exhaust gas by the scavenging air. The Hyperbar supercharging system provides an answer to this question by means of its particular very high efficiency method of operation. It also makes it possible to eliminate the scavenging blower coupled to the engine. An experimental approach to the very high supercharging of low compression-rate two-stroke Diesel engines is described here.

### TURBINE

*REFER ALSO TO CITATION(S) 21866, 21867*

### ROTARY

**21854** (N—77-26134) **Performance, emissions, and physical characteristics of a rotating combustion aircraft engine.** Berkowitz, M.; Hermes, W.L.; Mount, R.E.; Myers, D. (Curtiss-Wright Corp., Wood-Ridge, N.J. (USA)). Dec 1976. Contract NAS3-20030. 116p. (NASA-CR—135119; CW-WR—76-028.2). NTIS PC A06/MF A01.

The RC2-75, a liquid cooled two chamber rotary combustion engine (Wankel type), designed for aircraft use, was tested and representative baseline (212 KW, 285 BHP) performance and emissions characteristics established. The testing included running fuel/air mixture control curves and varied ignition timing to permit selection of desirable and practical settings for running wide open throttle curves, propeller load curves, variable manifold pressure curves covering cruise conditions, and EPA cycle operating points. Performance and emissions data were recorded for all of the points run. In addition to the test data, information required to characterize the engine and evaluate its performance in aircraft use is provided over a range from one half to twice its present power. The exhaust emissions results are compared to the 1980 EPA requirements. Standard day take-off brake specific fuel consumption is 356 g/KW-HR (.585 lb/BHP-HR) for the configuration tested.

## EXTERNAL COMBUSTION ENGINES

### STIRLING CYCLE

**21855** (COO—2631-22) **Stirling engine feasibility study of an 80 to 100 hp engine and of improvement potential for emissions and fuel economy. Final report.** (Ford Motor Co., Dearborn, Mich. (USA)). Nov 1977. Contract EY-76-C-02-2631. 136p. Dep. NTIS $7.25.

A study was made to evaluate the potential of a Stirling engine for significant improvement in emissions and fuel economy over the present-day internal combustion engine and to initiate, on the basis of the experience gained in the Ford/Philips 170 hp Stirling engine development program, the design of an engine in the 80 to 100 hp range suitable for use in a passenger car in the 2,500 to 3,000 lb weight class. The final report given covers two major tasks. Task I was the Contractor-financed testing of a 170 hp Stirling engine powered Torino passenger vehicle. The fuel economy of the 170 hp Stirling engine-powered Torino approximates that of similar 1977 model year production passenger vehicles in a comparable weight class, with comparable performance. Emissions meet the objective of 0.41/3.4/0.4 grams per mile (HC/CO/NO/sub x/). Task II was a design study of an 80 to 100 hp engine in a passenger car in the 2,500 to 3000 lb weight class based on the 170 hp Torino installation. The baseline vehicle selected for comparison purposes is a 1976 Pinto with a 2.3 liter 4-cylinder engine. The engine is rated 84 hp, with 4 double-acting cylinders, each of 98 cc displacement (4 to 98), and utilizes a swashplate drive. The swashplate Stirling engines did not package well in the compact car. Despite optimization of the engine to achieve minimum length, the Stirling powered compact car was 89 mm (3.5 inches) longer than its Pinto baseline. Fuel economy of the swashplate engine was adversely affected by attempts to fit it within the Pinto engine compartment. The 4 cylinder-dual crankshaft Stirling engine resulted in a very attractive vehicle. The engine packaged within the confines of the Pinto engine compartment. However, the packageable engine did not incorporate the rotary preheater as used on the swashplate engine. Emissions and noise level objectives could be met.

## ELECTRIC-POWERED SYSTEMS

*REFER ALSO TO CITATION(S) 21857*

**21856** (CONS/1011—21) **Test and evaluation of 23 electric vehicles for state-of-the-art assessment.** Dustin, M.O.; Denington, R.J. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1978. Contract EX-76-A-31-1011. 25p. Dep. NTIS, PC A02/MF A01.

The Electric and Hybrid Research, Development and Demonstration Act of 1976 required ERDA to develop data to determine the state-of-the-art of electric and hybrid vehicles. NASA, in response to ERDA's request, tested 18 electric vehicles. The U.S. Army's MERADCOM tested four electric vehicles and the Canadian Government tested one. Eleven of the electric vehicles were passenger cars and 12 were commerical vans. Tests were conducted in accordance with an ERDA test prodecure which is based on the SAE J227a Test Proceduce. Tests included range, acceleration, coast-down, and braking. The results of the tests and comments on reliability are presented.

## HYBRID SYSTEMS

**21857** (UCRL—52346) **Utilization of flywheels for the evolution of high-performance electric vehicles.** O'Connell, L.G.; Cooper, J.F.; Miller, A.B.; Newkirk, H.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Oct 1977. Contract W-7405-ENG-48. 16p. Dep. NTIS, PC A02/MF A01.

The performance of current and future electric vehicles is examined and compared with that of projected heat-engine vehicles. The shortcomings of electric vehicles in the near future are also discussed. It is predicted that the all-electric vehicle, even those utilizing flywheels to meet transient power demands, will not gain wide acceptance in the near future because of degraded performance characteristics. It is indicated that the flywheel always improves performance and range under certain circumstances. Therefore, a hybrid concept that can increase performance in the near future is examined. This type of vehicle as a much-needed transition system to provide an evolutionary change from the heat engine vehicle of today to future electric vehicles with acceptable performance.

## FLYWHEEL PROPULSION

*REFER ALSO TO CITATION(S) 21857*

**21858** (SAN/1164—1) **Evaluation of selected drive components for a flywheel powered commuter vehicle. Phase I. Final report.** (LMC Corp., Sparks, Nev. (USA)). 30 Jun 1977. Contract EY-76-C-03-1164. 67p. Dep. NTIS, PC A04/MF A01.

The results of tests performed to evaluate the performance of selected high-speed flywheel bearings and shaft seals are reported, and work performed on the development of a high-speed composite flywheel rotor is described. The overall program objective is to develop a composite flywheel system for primary energy storage in a flywheel powered vehicle. These initial tests were intended to evaluate the performance of full-size composite rotor elements, high-speed bearings and shaft seals for that system under conditions simulating as closely as possible those anticipated in a finished vehicle. Performance of the angular contact ball bearings is reported to be satisfactory at all speeds; a simplified lubrication system is recommended for second generation hardware. Performance of the ferrofluidic shaft seals is reported to be marginal, as they failed to hold a hard vacuum at the maximum design speed. Several concepts for improved seals are offered for second generation hardware. The test objectives for the high-speed composite flywheel rotor were not achieved due to dynamic instability problems with the test hardware. Recommendations are offered for the design of second generation hardware, and a scope of activities is proposed for the second phase of this program.

## VEHICLE DESIGN FACTORS

**21859** (SAND—78-0030C) **Speed, acceleration, and pulse prediction calculations on test vehicles with wheel pulse generators.** Kraft, C.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 6p. (CONF-780303—1). Dep. NTIS, PC A02/MF A01.

From IEEE vehicular technology conference; Denver, CO, USA (24 Mar 1978).

The use of microprocessors for calculation of dynamic quantities such as speed and acceleration on land based test vehicles which use wheel pulse generating probes is discussed. Methods of pulse prediction and windowing are presented along with formulas for

determining the existence of the next pulse. Considerations in actual implementation of a microprocessor for these tasks are brought out.

### ENGINE SYSTEM

*REFER ALSO TO CITATION(S) 21855*

**21860** (BERC/RI—77/13) **Investigative study of engine limiting.** Bechtold, R.L. (Department of Energy, Bartlesville, Okla. (USA). Bartlesville Energy Research Center). Feb 1978. 19p. Dep. NTIS, PC A02/MF A01.

An experimental study was conducted to determine the effect of cylinder cut-out or "engine limiting" on fuel consumption and exhaust emissions for a current technology V-type 8-cylinder engine. Increases in energy conversion efficiency while operating with only 4 cylinders ranged from 10 to 40% compared to operation with 8 cylinders at the same power outputs. The speeds and loads chosen were representative of those required to operate a 4,500-lb vehicle at speeds up to 60 mph. Hydrocarbon emissions increased at low speed/load points under 4 cylinder operation. An insignificant change in carbon monoxide emissions was observed while an increase in oxides of nitrogen emissions resulted at the higher speed/load points.

**21861** **Reciprocating internal combustion engine for operation with fuel in powder form.** Steiger, A. (to Sulzer Brothers Ltd.). US Patent 4,059,077. 22 Nov 1977. Priority date 7 Apr 1976, Switzerland. 10p.

The valve piston is charged with powdered fuel, such as coal, which is initially metered into a fuel transfer channel during a downward stroke of a dosing and ejecting member and then blown via compressed air through the valve piston into the combustion chamber upon completion of the downward stroke of the dosing and ejecting member. A slider is used to allow metering of the fuel without interference from the compressed air. After the fuel charge is metered, the slider moves transversely of the transfer channel to permit entry of the compressed air so that the charge can be blown into the combustion chamber via the valve piston.

**21862** **Steam injection apparatus.** de la Rosa, R.R. US Patent 4,059,078. 22 Nov 1977. Filed date 1 Jul 1976. 6p.

An apparatus for injecting steam into an internal combustion engine includes an exhaust manifold and an intake manifold, which has a control valve which receives and controls a flow of water supplied from a source or reservoir of same, and from which the flow of water controlled by the valve is delivered to an evaporator adapted to receive the exhaust gases of the engine and to convert the water passing therethrough into steam. The steam is then delivered to the intake manifold of the internal combustion engine, increasing the engine power and reducing the contaminants in the exhaust gases.

**21863** **Fuel conservation means for internal combustion engines and the like.** McCauley, R.A. US Patent 4,059,082. 22 Nov 1977. Filed date 2 Apr 1976. 8p.

A device is adapted to be interposed between the usual carburetor and manifold of an internal combustion engine, or the like, for receiving the fuel-air mixture from the carburetor and discharging same into the manifold. The device comprises three components or stages: a rotor member, a sonic vibrator, and a heated grid means. The rotor member is mounted in the flow stream of the fuel-air mixture and is rotated by the air intake for causing oscillation of the fuel-air mixture from the carburetor. The fuel-air mixture then enters the sonic vibration stage which causes a molecular mixing of the fuel with the air. The mixed fuel-air is then passed through the heated grid or screen, which not only straightens out the path of the flow stream of the fuel-air mixture, but also promotes vaporization of the fuel-air mixture impinging the screen, and receiving the heat by radiation. A magnetic force field is possibly established in the area of the screen or grid which magnetically affects the molecular structure of the hydrocarbon content of the fuel-air mixture to provide a more efficient power conversion of the fuel-air mixture.

**21864** **What use are econometers. Greater discipline in driving by fuel consumption indicating devices.** Frenzel, M. *VDI (Ver. Dtsch. Ing.) Nachr.;* **31**: No. 34, 4, 12(Aug 1977). (In German).

The mixing process in an Otto motor is better the greater the vacuum in the intake duct of the motor. Via the control of this vacuum one can thus determine whether the motor is being economically operated. Two different vacuum gages are presented which can subsequently be inserted without any great difficulty. It was found in test drives that by using such vacuum gages, a more economical motor operation can be achieved.

## EMISSION CONTROL

*REFER ALSO TO CITATION(S) 21862*

**21865** **After-burning preventive and flame-out apparatus.** Mizusawa, S.; Tamura, C.; Nakamura, N.; Yanagihara, H. (to Toyota Jidosha Kogyo Kabushiki Kaisha). US Patent 4,056,934. 8 Nov 1977. Priority date 27 Sep 1975, Japan. 8p.

An improved flame-out apparatus for use in a muffler of an internal combustion engine is described. The apparatus includes first and second L-shaped screens each having a longitudinal section and a transverse section. The transverse sections are axially spaced apart and the space therebetween is occupied by a pair of axially spaced apart, transversely oriented perforated partition plates and flame extinguishing means.

### NITROGEN OXIDES

*REFER ALSO TO CITATION(S) 21855, 21860*

**21866** **Experimental study on the emissions of a model gas turbine combustor.** Katsuki, M.; Mizutani, Y.; Shibuya, K. (Osaka Univ., Suita, Japan). *Combust. Sci. Technol.;* **17**: No. 1/2, 11-18(1977).

Temperature distribution and species concentrations in a model gas turbine can-type combustor were measured for various operating conditions. Effects on emissions of inlet air temperature, swirl number and primary air-fuel ratio were examined. The combustion process in the upstream part of the combustor was accelerated by the increase in inlet air temperature, the resultant higher temperature level throughout the combustor reducing the emission of carbon monoxide. The formation of nitric oxide, however, is governed by the combination of local temperature and equivalence ratio. Heterogeneous effects are also significant in the formation and abatement of pollutants.

**21867** **Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission.** Katsuki, M.; Mizutani, Y. (Osaka Univ., Suita, Japan). *Combust. Sci. Technol.;* **17**: No. 1/2, 19-28(1977).

An axi-symmetrical two-dimensional mechanistic model of gas turbine combustors has been developed which enabled a point-by-point study on the formation and abatement of nitric oxide taking both chemical reactions of finite rate and turbulent transport processes into account simultaneously. Two-dimensional distribution maps of velocities, temperature, nitric oxide concentration and equivalence ratio, as well as the variation of combustion efficiency in axial direction have been obtained numerically for a small combustor of can-type, and the effects of combustor parameters on nitric oxide emission are also discussed.

### CARBON MONOXIDE

*REFER ALSO TO CITATION(S) 21855, 21860, 21866*

### HYDROCARBONS

*REFER ALSO TO CITATION(S) 21855, 21860*

## ALTERNATIVE FUELS

*REFER ALSO TO CITATION(S) 21861*

**21868** (NP—22771) **Methanol from natural gas for engine fuel. 2nd interim report. Report No. 23.** Judd, B.T.; Walker, B.V.; Graham, E.E.; Rees, I.F.; Girardin, E.K. (New Zealand Energy Research and Development Committee, Auckland). Jun 1977. 30p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The water tolerance of the methanol/i-octane/benzene system was studied, including the effect on the water tolerance of the presence of selected additives. The conclusions derived from these results are applied to consideration of the methanol/gasoline system with particular attention being given to the effect of i-butanol additions on the water tolerance of the resulting blends. It is concluded that methanol/gasoline/i-butanol blends can be obtained of adequate stability for commercial distribution. Results show that the use of emulsifying agents to achieve stable blends is not technically possible at the present time. The corrosive effect of methanol on the materials currently used in vehicle fuel systems and in the fuel distribution system is discussed. It is recognized that the introduction of methanol/gasoline blends could create problems in the area of materials compatibility vis-a-vis gasoline and it is recommended that additional work be initiated to provide more detailed information than is presently available. The problem of increased vapor pressure and methods of distribution of methanol/gasoline blends are noted. Results of initial experimental work undertaken with a single cylinder Ricardo engine are described. These indicate that the air to fuel ratio at which the engine is operated is of critical importance. These preliminary experiments suggest that the use of a 10% methanol/gasoline blend would not be significantly different from the use of pure gasoline in operating engines. The need for further extensive

work is indicated, however, both with single cylinder and multi-cylinder engines.

**21869 Methanol as an automotive fuel.** Vendil, D. (Svensk Methanolutveckling AB, Stockholm). *Kem. Tidskr.;* **88**: No. 3, 30-35(Mar 1976). (In Swedish).

This article describes pros and cons of methanol as an automotive fuel. The recently funded Swedish Methanol Development Company is conducting research with methanol. These activities are described and plans for developing methanol in other countries are mentioned.

# MATERIALS

*REFER ALSO TO CITATION(S) 21331, 21657*

## METALS AND ALLOYS

*REFER ALSO TO CITATION(S) 21363, 21568, 21587, 21593*

### PREPARATION AND FABRICATION

*REFER ALSO TO CITATION(S) 21885, 21888*

**21870** (AD-A—042188) **Summary report on investigation of metal processing operations. Final report 15 December 1973—22 March 1977.** Gurney, F.J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Advanced Energy Systems Div.). Apr 1977. Contract F33615-74-C-5059. 87p. NTIS PC A05/MF A01.

This report summarizes the findings of several investigations involving the influence of process variables on the production of shapes with specified geometry, controlled microstructure and controlled structural integrity. The studies include the room temperature strengthening influence of grain boundary and subgrain boundary effects resultant from deformation of aluminum alloys; the microstructure and mechanical properties of extrusion consolidated 7075 Al powder; evaluation procedures for determining characteristics of workpiece coatings for isothermal forging; and the development and evaluation of separation-lubrication substances for titanium isothermal forging operations. Information derived from these investigations was applied to the processing of numerous experimental metalworking operations related to other alloy and processing development programs of interest to the Air Force and other government agencies.

**21871** (AD-A—042253) **Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972—31 May 1975.** Lindfors, P.A. (Minnesota Univ., Minneapolis (USA). Physical Electronics Lab.). May 1977. Contract F33615-72-C-2105. 138p. NTIS PC A07/MF A01.

More than 15 years after its discovery, $Na_2KSb$(Cs) remains an important photocathode material, but control of its formation remains a problem. In these studies Auger electron spectroscopy (AES) was used to determine the atomic species present in the surface region during formation of $Na_2KSb$(Cs) films. It was found that the electron bombardment incidental to the use of the AES technique could cause sample changes, but this problem was eliminated for samples that were heated during or after constituent depositions. Important conclusions derived from these studies are as follows: 1. Heating to temperature greater than 200 C at the 2Na + $K_3Sb$ yields 2K + $Na_2KSb$ stage of formation is probably required to produce antimony-rich material, if formation is approached from an alkali-rich standpoint. Alkali antimonide photocathodes of high sensitivity are thought to be 'p' type due to an excess of antimony. 2. The relative populations of the constituents are factors in determining which alkali species will leave when an alkali antimonide film is heated. 3. An alkali overlayer can exist on an alkali antimonide sample that is alkali-deficient in the bulk. 4. An alkali overlyaer is probably present on photocathodes of high sensitivity, and Cs is probably present in that overlayer.

**21872** (AD-A—042443) **Wear resistant coatings for titanium alloys. Final report 15 March 1976—15 March 1977.** Manty, B.A.; Liss, H.R. (Pratt and Whitney Aircraft, West Palm Beach, Fla. (USA). Government Products Div.). Mar 1977. Contract N00019-76-C-0342. 74p. (FR—8400). NTIS PC A04/MF A01.

Techniques for applying chromium-molybdenum alloys to titanium alloy substrates were developed, and the resulting systems, evaluated as protective coating. Deposition techniques including electroplating and sputtering were considered, and diffusion properties, studied. A coating alloy containing 1% molybdenum was shown greatly to improve the wear resistance. Erosion, oxidation and stress corrosion properties were also improved. The coatings system had no apparent effect on fatigue properties of Ti 8Al-1V-1Mo at either room temperature or 315 C.

**21873** (BDX—613-1634(Rev.)) **Development of plating thickness standards for the physical vapor deposition of aluminum on Kapton.** Russell, R.J. (Bendix Corp., Kansas City, Mo. (USA)). Sep 1977. Contract EY-76-C-04-0613. 33p. Dep. NTIS, PC A03/MF A01.

Reference and working standards for determining nondestructively the thickness of aluminum-on-Kapton plating, unobtainable either commercially or from the National Bureau of Standards, were developed at Bendix Kansas City. The results from the calibration data of the reference standards indicate that thickness values are within +-152.4 nm (+-6 microinches). 10 figures, 8 tables.

**21874** (ZJE—186) **Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress.** Becka, J.; Kupka, I. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1976. 30p. Dep. NTIS (US Sales Only), PC A03/MF A01.

The methods are compared of electroslag welding and of arc welding with a view to their possible application in welding the Bohunice A-1 reactor pressure vessel. Considered are the thermal deformation effects of welding on the physical properties and the stress present in welded joints. For testing, plates were used having the dimensions of 1100x2300x200 mm and rings with 4820 mm outer diameter, 1800 mm height and 170 mm thickness made of steel CSN 413O30 modified with Ni, Al+Ti. The deformation effect of welding on the residual surface and triaxial stress, the specific stored energy, the initiation temperature of brittle crack and the critical size of the initiation defect corresponding to the thermal deformation effect of welding were determined. It was found that for electroslag welding, there is a low probability of crack formation in the joints, a low level of residual stress and a low level of specific stored energy in a relatively wide joint zone. For arc welding there is a considerable probability of defect formation in the vicinity of the sharp boundary of the joint, a high level of the triaxial state of stress in the tensile region, and a high level of specific stored energy concentrated in the narrow zone of weld joints. The recommended thermal process is given for welding pressure vessels made of the CSN 413030 steel modified with Ni, Al+Ti, and 150 to 200 mm in thickness.

**21875 Peak effect in type II superconductors.** Borka, S.; Goncharov, I.N.; Fricsovszky, D.; Khukhareva, I.S. (Joint Institute of Nuclear Research). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 6, 347-351(Jun 1977).

Results of investigations of the behavior of the static (I/sub c/ ) and dynamic (I/sub d/) critical currents near H/sub c/(T) are reported, where the former is determined for constant threshold voltage, and the latter by an extrapolation of the linear part of the current—voltage characteristic (CVC) to zero voltage. The measurements were performed for a series of specimens ($\kappa$=50) with different microstructures in a broad temperature range. A peak effect is detected on I/sub d/(H) vertical-bar/sub T/ and I/sub c/(H) vertical-bar/sub T/. In certain cases, two peaks, which differ from each other in their temperature dependence, are observed on I/sub c/(H), where the high field peak is similar in its behavior to the dynamic current peak. The presence of the lower peak, which is accompanied by a large modification in the lower part of the CVC is explained by an increase in the degree of synchronization of vortex interaction with pinning centers in the static state of the vortex latice as H→H/sub c/(T). The peak of the dynamic critical current is related to an increase in the number and (or) efficiency of the pinning centers near the upper critical magnetic field, where the strong temperature dependence of the peak magnitude obtained (~[H/sub c/(T)]/sup 4.6/ can be explained under an assumption about the importance of the influence of inhomogeneities in the electron mean free path.

**21876** (BNWL-tr—277) **Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques.** Bollinger, H.; Schulze, D.; Wilberg, R. Translated from *Neue Huette;* **21**: No. 3, 145-149(Mar 1976). 17p. Dep. NTIS, PC A02/MF A01.

The coating of metals and intermetallic compounds as well as organic and inorganic non-metallic materials on given substrates by means of vacuum techniques has assumed an increasing technical importance in the last decade. The chief area of application of vacuum technology coating methods is represented by thin film techniques in electronics. By means of modern methods--based on more efficient vacuum technology equipment--the deposition of metal films up to more than 50 $\mu$m thick is possible without difficulty. Thus, vacuum coating techniques and the selective changing of the properties of metallic surfaces through vacuum technologies offer an alternative to electroplating and flame spraying. In principle, all metallic substances and intermetallic compounds can be precipitated out in a vacuum, and aluminum, zinc, magnesium, titanium, cadmium, and lead can be economically deposited especially well in thick layers. With the possibility of applying aluminum,

titanium, and magnesium coats on given substrates in a vacuum, an existing gap in electroplating is closed.

## STRUCTURE AND PHASE STUDIES

*REFER ALSO TO CITATION(S) 22317*

**21877** (CONF-761027—25) **Vacancy properties in gold.** Sahu, R.P.; Jain, K.C.; Siegel, R.W. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science; General Instrument Corp., Hicksville, N.Y. (USA); Argonne National Lab., Ill. (USA)). 1976. Contract W-31-109-ENG-38. 41p. Dep. NTIS, PC A03/MF A01.

From International conference on properties on atomic defects on metals; Argonne, IL, USA (18 Oct 1976).

A detailed, multi-parameter fitting analysis has been performed on the experimental data available for self-diffusion, equilibrium vacancy concentrations and effective vacancy migration energies, obtained from direct observations of vacancy precipitation after quenching, in gold. The ranges of allowed values for the various vacancy activation enthalpies were determined. Limits were also obtained for the various pre-exponential or entropy factors. Since within these limits correlations among the possible parameter values exist, the results of the combined analyses are presented as fields in parameter-space. The value of this type of fitting procedure for deducing vacancy defect properties from experiment is discussed. A representative set of allowed vacancy parameters was used to computer-model a quench and subsequent recovery. These calculations demonstrated the self-consistency of the assumption of local equilibrium for the analyses of these vacancy precipitation results.

## MECHANICAL PROPERTIES

*REFER ALSO TO CITATION(S) 20879, 21556, 21564, 21609*

**21878** (COO—4246-2) **Microstructural effects in abrasive wear. Quarter progress report, June 16—September 15, 1977.** Fiore, N.F. (Notre Dame Univ., Ind. (USA). Coll. of Engineering). 1 Oct 1977. Contract EF-77-S-02-4246. 32p. Dep. NTIS, PC A03/MF A01.

Standard procedures have been developed for low-stress abrasion testing, based on a rubber wheel test system, and for gouging abrasion testing, based on a grinding wheel test system. AISI 1020 and 4340 steels have been evaluated as test standards for both systems, and the 1020 has been found to provide best reproducibility. Low-stress testing has been conducted on 2.7C and 3.5C pearlitic, 15Cr-3Mo, 27Cr and Ni-Hard 4 white irons. Microstructural effects are evident in that the 3.5C iron has substantially greater low-stress wear resistance than the 2.7C iron. Moreover, wear resistance across $FE_3C$ dendrites is greater than that normal to dendrites. The Ni-Hard 4 irons have retained austenite ranging from 5 to 85% volume fraction. Weight loss during wear is at a maximum for 40% retained austenite, indicating that the interrelation between carbide, martensite and retained austenite volume fraction is complex. Work is underway to quantitatively relate wear behavior to microstructure and mechanical properties such as fracture toughness.

**21879** **Isothermal compression of bcc transition metals to 100 kbar.** Ming, L.; Manghnani, M.H. (Hawaii Institute of Geophysics, University of Hawaii, Honolulu, Hawaii 96822). *J. Appl. Phys.;* **49**: No. 1, 208-212(Jan 1978).

Pressure-volume relationships for the bcc transition metals in the groups VB (V, Nb, and Ta) and VIB (Cr, Mo, and W) were determined under hydrostatic pressure to 100 kbar at room temperature by means of x-ray diffraction, employing diamond-anvil pressure cell and the ruby ($R_1$ line) fluorescence calibration technique. Using the measured ultrasonic K'o values, where $K_o$ is the bulk modulus at ambient pressure, for five metals and the deduced shock-wave K'o value for Cr, the values of $K_o$ for V, Nb, Ta, Mo, W, and Cr are calculated to be 1.54, 1.71, 1.94, 2.67, 3.07, and 1.93 Mbar, respectively, by least-squares fit of the experimental P-V data to the Birch-Murnaghan equation. The $K_o$ values thus determined are in good agreement with the ultrasonic and shock-wave values for V, Nb, Ta, Mo, and W. For Cr, the $K_o$ value (1.93 Mbar) is in agreement with the shock-wave value (1.92 Mbar) but not with the ultrasonic value (1.65 Mbar). This discrepancy can be explained in view of the paramagnetic→antiferromagnetic transition in Cr in the temperature proximity of the ultrasonic measurements (Neel temperature T/sub N/~311 °K at 1 bar) and by the negative pressure dependence of T/sub N/.

## PHYSICAL PROPERTIES

*REFER ALSO TO CITATION(S) 20871, 20879, 20880, 22681, 22682*

**21880** (AD-A—042702) **Comparative study of electron—phonon interaction in three vanadium samples of varying purity. Interim report1 October 1973—30 September 1975.** Waynert, J.A.; Levy, M. (Wisconsin Univ., Milwaukee (USA). Dept. of Physics). Jan 1977. 7p.

The ultrasonic attenuation coefficient has been measured in the mixed state of three samples of single crystal vanadium of varying purity in order to determine the effect of impurities on theelectron—phonon interaction in the mixed state of vanadium. The resistivity ratio of the three samples was 8, 245, and 400. Within experimental error the superconducting energy gap of the three samples was 3.5 kTc. The electron mean free path determined ultrasonically was 0.4, 2.1 and 0.0004 cm, respectively. A recent theory is presented which indicates that electron—phonon interaction is a strong function of the electron mean free path in the mixed state. The relative attenuation decreases more rapidly for the purer samples as the magnetic field is decreased from the upper critical field, and therefore, the electron—phonon interaction term also decreases more rapidly. There appears to be good quantitative agreement between the experimental results and the theoretical predictions.

**21881** (IS-T—778) **Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum.** Jensen, C.L. (Ames Lab., Iowa (USA)). Oct 1977. Contract W-7405-ENG-82. 137p. Dep. NTIS, PC A07/MF A01.

Thesis. Submitted to Iowa State Univ. of Science and Technology, Ames.

The electric mobility and effective valence of hydrogen and deuterium in vanadium, niobium, tantalum and three niobium-tantalum alloys were measured. A resistance technique was used to directly determine the electric mobility of hydrogen and deuterium at 30°C while a steady-state method was used to measure the effective valence. The use of mass spectrographic techniques on a single specimen which contained both hydrogen and deuterium greatly increased the precision with which the isotope effect in the effective valence could be measured.

**21882** (IS-T—780) **Low temperature heat capacity of scandium and alloys of scandium.** Tsang, T.W.E. (Ames Lab., Iowa (USA)). Dec 1977. Contract W-7405-ENG-82. 162p. Dep. NTIS, PC A08/MF A01.

Thesis.

The heat capacity of three electrotransport purified scandium samples has been measured from 1 to 20°K. The resultant electronic specific heat constant and Debye temperature are 10.337 +- 0.015 mJ/gm-atom $K^2$ and 346.7 +- 0.8°K respectively, and these values are believed to be truly representative of intrinsic scandium. Alloying studies have also been carried out to investigate the band structure of scandium based on the rigid band model, with zirconium to raise the electron concentration and magnesium to lower it. The results are then compared to the theoretical band structure calculations. Low temperature heat capacity measurements have also been made on some dilute Sc-Fe alloys. An anomaly is observed in the C/T vs. $T^2$ plot, but the C vs. T curve shows no evidence of magnetic ordering down to 1°K, and electrical resistance measurement from 4 to 0.3°K also indicates that no magnetic ordering took place.

**21883** (LBL—6906) **Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources.** Apai, G.R. II. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1977. Contract W-7405-ENG-48. 120p. Dep. NTIS, PC A06/MF A01.

Thesis.

Photoemission energy distribution experiments on clean metal and adsorbate-covered surfaces were performed under ultrahigh vacuum conditions by using x-ray and ultraviolet photon sources in the laboratory as well as continuously-tunable, highly polarized synchrotron radiation obtainable at the Stanford Synchrotron Radiation Laboratory (SSRL). Studies focused on two general areas: cross-section modulation in the photoemission process was studied as a function of photon energy and orbital composition. Sharp decreases in intensity of the valence bands of several transition metals (i.e., Ag, Au, and Pt) are attributed to the radial nodes in the respective wave functions. Adsorbate photoemission studies of CO adsorbed on platinum single crystals have demonstrated a very high spectral sensitivity to the $4\sigma$ and $(1\pi + 5\sigma)$ peaks of CO at photon energies of 150 eV. Angle-resolved photoemission allowed determination of the orientation of CO chemisorbed on a Pt (111) or Ni(111) surface. Prelinimary results at high photon energies (approximately 150 eV) indicated scattering from the substrate which could yield chemisorption site geometries.

**21884** (TRG-Report—2953(S)) **Technology and assessment of neutron absorbing materials.** Kelly, B.T.; Murgatroyd, R.A. (SEE ALSO- 6413040 UKAEA Reactor Group, Risley). Jun 1977. 92p. Dep. NTIS (US Sales Only), PC A05/MF A01.

The present review assesses more recent developments in the technology and application of those absorber materials which are considered to be established or to have shown potential in reactor

control. Emphasis is placed on physical, chemical and metallurgical properties and upon irradiation behaviour.

**21885 Solid-state (bronze process) $V_3Ga$ from a V-Al alloy core.** Dew-Hughes, D. (Brookhaven National Laboratory, Upton, New York 11973). *J. Appl. Phys.;* **49**: No. 1, 327-332(Jan 1978).

$V_3Ga$ has been prepared as a single-filament wire by the solid-state reaction of a composite consisting of a vanadium 10.1 at.% aluminum alloy core in a bronze matrix of copper 16.7 at.% gallium. Reaction temperatures varied from 525 to 750 °C. Reacted layer thicknesses are found to increase as (reaction time)/sup 1/2/. Rates of layer growth and activation energies are compared for a variety of starting composites. The addition of Al to the core enhances the rate of growth of the $V_3Ga$ layer, particularly at temperatures below 600 °C. Aluminum is incorporated within the $V_3Ga$ layer to the extent of 2—7.5 at.%. The superconducting transitions have onset temperatures of 15.0—15.3 K, with midpoints of 14.0—14.6 K. The (paramagnetically limited) upper critical fields at 4.2 K are 21—22 T. Critical-current densities were measured up to the critical field and approach those of Howe and Weinmann for material with gallium in the core. The form of the dependence of pinning force on field differs from that of Howe and Weinmann's specimens in which a different pinning mechanism must operate.

**21886 Viscous drag on mobile dislocations in type-II superconductors.** Pang, C.S.; Lin, T.H.; Galligan, J.M. (Department of Metallurgy and Institute of Materials Science, University of Connecticut, Storrs, Connecticut 06268). *J. Appl. Phys.;* **49**: No. 1, 333-337(Jan 1978).

The difference in the stress for plastic deformation between the mixed state and the superconducting state has been measured in a series of lead-indium crystals. These measurements show that the change in drag stress between the two states varies in the same manner as does the ultrasonic attenuation in a type-II superconductor. Quantitative agreement between the present results and Maki's theory of transport properties in dirty superconductors is found for higher solute concentration crystals. These results show that dislocation motion in these lead-indium alloys can be treated as an underdamped oscillator.

**21887 Critical-current densities of bronze-processed $Nb_3$(Sn/sub 1-x/Ga/sub x/) wires up to 23.5 T.** Dew-Hughes, D.; Suenaga, M. (Brookhaven National Laboratory, Upton, New York 11973). *J. Appl. Phys.;* **49**: No. 1, 357-360(Jan 1978).

Gallium additions to the Cu-Sn bronze matrix in the production of $Nb_3Sn$ wires by solid-state diffusion raise H/sub c/(4.2 K) of the resulting compound to ~25 T. This increase in H/sub c/, which is not accompanied by any significant increase in T/sub c/, is associated with the incorporation of gallium into the A-15 compound which has the approximate composition $Nb_3$(Sn/sub 0.9/Ga/sub 0.1/). Critical currents in a variety of Ga-containing wires, all reacted at 700 °C, have been measured in fields up to 23.5 T. This is the highest field at which steady-state current measurements have yet been made. The pinning force is found to be closely proportional to h/sup 1/2/ $(1\text{-}h)^2$, where h is the reduced field.

**21888 Superconductivity of rapidly condensed films.** Pertrosyan, V.I.; Vasin, O.I.; Stenin, S.I.; Bondarenko, N.F.; Skripkina, P.A. (Institute of Semiconductor Physics, Siberian Division, USSR Academy of Sciences). *JETP Lett. (USSR) (Engl. Transl.);* **26**: No. 1, 8-11(5 Jul 1977).

With InSb as an example, it was demonstrated that it is possible to produce and stabilize films of crystalline metastable superconducting phases having the structure of high-pressure phases, by rapid condensation on cooled substrates, followed by heat treatment.

**21889 Vortex-pinning forces in superconducting niobium-zirconium alloys with low j/sub c/.** Borka, S.; Goncharov, I.N.; Frichevski, D.; Khukhareva, I.S. (Joint Institute for Nuclear Research). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 5, 289-292(May 1977).

The critical currents are studied in the entire region of existence of the mixed state in ribbon specimens of Nb—80% Zr in recrystallized and cold-deformed states (magnetic field perpendicular to the surface). It is found that at low temperatures the pinning force F/sub c/ grows exponentially with a decrease in h=H/H/sub c2/(T) from the region of the peak effect, while its more rapid growth (by a power law) is observed at small h with the approach to T/sub c/. The temperature dependence with small h=const can be represented in the form F/sub c/~$H^2$/sub c2/(T), while F/sub c/ varies more strongly with temperature as h→1. The results are compared with the Larkin-Ovchinnikov theory, which analyzes the pinning on inhomogeneities of the effective electron-interaction constant and of the electron mean free path.

**21890 Magnetic properties of zinc and of cadmium alloys with magnesium and with mercury.** Svechkarev, I.V.; Kuz'micheva, L.B.; Poltoratskii, V.I. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 5, 323-330(May 1977).

A study was made concerning the magnetic susceptibility of single crystals of binary cadmium-magnesium and cadmium-mercury alloys, within the range of existence of disordered solid solutions and of ternary cadmium-magnesium-mercury alloys, the temperature-susceptibility characteristics of these alloys over the 4.2—300°K range, and also the effect of uniaxial elastic strains and dislocations on the anisotropy of the magnetic susceptibility of zinc. From the anomalies of the magnetic susceptibility the locations of the critical points in the cadmium spectrum were then determined, and the separation between bands responsible for the magnetic properties was calculated. Owing to the smallness of this separation, the magnitude of the magnetic field intensity was found to affect appreciably the monotone component of the electron susceptibility. The nature of the influence which the temperature and the impurities have on the structure of the cadmium spectrum is analyzed here, and the scattering of electrons by the mercury impurity is evaluated.

**21891 Anomalous diffusion in bcc metals of the 5th and 6th groups (Mo, Nb, Ta, W).** Lesage, B.; Huntz, A.M. (Paris-11 Univ., 91 - Orsay (France)). pp 137-153 of In 19. Colloquium on metallurgy. Diffusion in condensed mediums. Theory and applications. Saclay, 22-25 June 1976. Vol. 1. Gif-sur-Yvette, France; Institut National des Sciences et Techniques Nucleaires (1977). (In French)

From 19. colloquium on metallurgy. Diffusion in condensed mediums. Theory and applications; Saclay, France (22 Jun 1976). See CONF-7606124—.

The fact that solute diffusion and self-diffusion in Mo, Ni, Ta and W do not follow the Arrhenius law was analyzed, using the Kidson model. This model involves two types of vacancies: the first ones are associated with impurities, the second ones are of thermal origin. This model seems to be able to explain these anomalies and also shows that different mechanisms occur according to the temperature: at low temperature the low values of the activation energy correspond to the migration enthalpies of the first type of vacancies, when high activation energy values observed at high temperature correspond to the formation and migration enthalpies of type-2 vacancies.

**21892 Anomalous self-diffusion in rare earths and actinides.** Marbach, G.; Boidron, M.; Fromont, M.; Calais, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). pp 91-101 of In 19. Colloquium on metallurgy. Diffusion in condensed mediums. Theory and applications. Saclay, 22-25 June 1976. Vol. 1. Gif-sur-Yvette, France; Institut National des Sciences et Techniques Nucleaires (1977). (In French)

From 19. colloquium on metallurgy. Diffusion in condensed mediums. Theory and applications; Saclay, France (22 Jun 1976). See CONF-7606124—.

Self-diffusion parameters were measured in Pu, Np, Ce, La, Yt and Gd. In the close packed phases at low temperature and in europium (metal which has a bcc phase only), the diffusion parameters are normal. In the bcc lattices, the diffusion parameters can be interpreted in a simple manner by a mechanism involving very relaxed vacancies or the associated defects of the OMEGA cluster type described by Sanchez and de Fontaine.

## CORROSION AND EROSION

*REFER ALSO TO CITATION(S) 20871, 20872, 20880, 20983, 21049, 21068, 21076, 21180, 21254, 21255, 21468, 21513, 21560, 21565, 21616, 21878*

**21893 Corrosion resistance of vanadium and vanadium alloys as structural materials in a lithium cooled fusion reactor.** Borgstedt, H.U. (Kernforschungszentrum Karlsruhe (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). *Werkst. Korros.;* **28**: No. 8, 529-535(Aug 1977). (In German).

From 8th meeting of the task group 'Corrosion in nuclear engineering' of the Europaeische Foederation Korrosion; Beznau, Switzerland (30 Sep 1976).

Liquid lithium has a potential as a blanket fluid of a D-T fusion reactor. Its effects upon solid materials are physical solution and chemical exchange processes. The exchange reactions are favoured by the fact that the solubility and the free enthalpies of formation of compounds of oxygen, nitrogen, carbon, and hydrogen are relatively high. Vanadium and its alloys are not affected by physical solution as is the case with nickel. However, oxygen can be removed by lithium, carbon can be exchanged between the melt and the solid metal, and nitrogen will be picked-up by the vanadium alloys. Procedures to decrease the extent of exchange are discussed. If the exchange reactions can be widely suppressed, vanadium alloys will be potential materials for the application in a D-T-Li fusion reactor up to high temperatures.

## RADIATION EFFECTS

*REFER ALSO TO CITATION(S) 21556, 21610, 21884, 22386, 22679, 22681*

**21894** (UCID—17665) **DT fusion neutron irradiation of LLL stainless steel tensile specimens at 450°C.** MacLean, S.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Jun 1977. Contract W-7405-ENG-48. 8p. Dep. NTIS, PC A02/MF A01.

The DT fusion neutron irradiation of five LLL stainless steel tensile specimens at 450°C is described. The sample position, beam-on time, and neutron dose record are given. The maximum neutron fluence on any sample was 2.58 x $10^{17}$ neutrons/$cm^2$.

**21895** (UCID—17666) **DT fusion neutron irradiation of LLL Nb—1Zr tensile specimens at 600°C.** MacLean, S.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Aug 1977. Contract W-7405-ENG-48. 8p. Dep. NTIS, PC A02/MF A01.

The 600°C DT fusion neutron irradiation of five LLL Nb-1Zr tensile specimens is described. The sample position, beam-on time, and neutron dose record are given. The maximum neutron fluence on any sample was 2.65 x $10^{17}$ neutrons/$cm^2$.

**21896 Temperature dependence of helium blistering in nickel monocrystals.** Sinha, M.K.; Das, S.K.; Kaminsky, M. (Argonne National Laboratory, Argonne, Illinois 60439). *J. Appl. Phys.;* **49**: No. 1, 170-172(Jan 1978).

The (110) and (111) planes of monocrystalline nickel targets have been bombarded with 500-keV $^4He^+$ ions under channeling conditions for a total dose of 6 x $10^{18}$ ions/$cm^2$ and for target temperatures ranging from room temperature to 950 °C. The results indicate a decrease in average blister diameter with increase in target temperature. Large-scale exfoliation of blister skin occurs at 300 °C, and, above 850 °C, holes are observed on the surface.

**21897 Electrical and recombination characteristics of Cd/sub x/Hg/sub 1-x/Te irradiated with electrons at T=300° K.** Brudnyi, V.N.; Voitsekhovskii, A.V.; Grechukh, Z.G.; Krivov, M.A.; Lilenko, Y.V.; Limarenko, L.N.; Pashkovskii, M.V.; Petrov, A.S.; Potapov, A.I. (V. D. Kuznetsov Siberian Physicotechnical Institute at the State University, Tomsk). *Sov. Phys. - Semicond. (Engl. Transl.);* **11**: No. 8, 905-907(Aug 1977).

Single crystals of n- and p-type Cd/sub x/Hg/sub 1-x/Te (x%=0.24—0.28) were irradiated at T=300°K with 2.0 MeV electrons at doses of up to 2.2 x $10^{18}$ $cm^{-2}$. Studies were made of the electrical (R/sub H/,$\sigma$, and R/sub H/$\sigma$) and recombination (tau) parameters of samples subjected to irradiation and isochronous annealing in the temperature range 300—430° K. It was found that, whatever the initial type of conductivity, the saturation parameters of strongly irradiated Cd/sub x/Hg/sub 1-x/Te crystals corresponded to an n-type material with n≅5x$10^{15}$ $cm^{-3}$ and R/sub H/$\sigma$≅ (2—4) x $10^4$$cm^2$x$V^{-1}$xsec$^{-1}$ at 78° K. Electrons irradiation did not lead to the formation of additional recombination centers. An isochronous annealing stage was found at T=370—430° K. It is suggested that the observed changes in the properties of Cd/sub x/Hg/sub 1-x/Te under electron irradiation are due to the formation of vacancy clusters.

**21898 Capture of positrons by radiation defects in germanium.** Arifov, P.U.; Arutyunov, N.Y.; Il'yasov, A.Z. (Institute of Electronics, Academy of Sciences of the Uzbek SSR, Tashkent). *Sov. Phys. - Semicond. (Engl. Transl.);* **11**: No. 8, 907-910(Aug 1977).

It was found that the positron annihilation method could be used to study the thermodynamic characteristics of disordered regions in germanium. The method of angular correlation of the annihilation $\gamma$ rays was used to study positron annihilation in germanium irradiated with fast reactor neutrons. The results indicated that positrons were captured by defects formed as a result of neutron irradiation. A study of the influence of isochronous annealing (involving measurement of the counting rate at the maximum of the angular correlation curve) revealed the existence of two stages of annealing of those defects which acted as the positron-capture centers. The first stage was described by a chemical kinetics equation of the first order with an activation energy of 0.18 eV and attributed tentatively to the "evaporation" of vacancies from disordered regions formed by fast neutrons; the second annealing stage obeyed a chemical kinetics equation of the second order with an activation energy of 1.8 eV.

**21899 Microstructure of high-dose multiple energy $He^+$ implanted stainless steel.** Thomas, G.J.; Wilson, K.L. (Sandia Labs., Albuquerque, NM). *Trans. Am. Nucl. Soc.;* **27**: 273-274(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

# CERAMICS, CERMETS, AND REFRACTORIES

## STRUCTURE AND PHASE STUDIES

**21900** (SAND—77-6024) **Solid phases of the $Bi_2O_3$—PbO system: identification and evolution as a function of temperature.** Boivin, J.C.; Tridot, G. Translated from *C. R. Hebd. Seances Acad. Sci., Ser. C;* **278**: 865-867(18 Mar 1974). 9p. Dep. NTIS, PC A02/MF A01.

A study of the solid phases of the system above 500°C has revealed the existence of five well defined compounds and six solid solutions. The compounds are $6Bi_2O_3$ . PbO, $3Bi_2O_3$ . 2PbO, $4Bi_2O_3$ . 5PbO, $3Bi_2O_3$ . 7PbO and $Bi_2O_3$ . 3PbO. Two of the solid solutions, $\alpha_2$ and $\beta$, are stable at high temperature. Three others are polymorphic varieties of the preceding forms: $\alpha_1$ for $\alpha_2$, and $\beta_1$ and $\beta_2$ for $\beta$. Only $\gamma$ does not undergo transformation. (GHT)

## MECHANICAL PROPERTIES

*REFER ALSO TO CITATION(S) 20856*

## PHYSICAL PROPERTIES

*REFER ALSO TO CITATION(S) 21676, 21758*

**21901** (CONF-771080—2) **Uranium nitride: a cubic antiferromagnet with anisotropic critical behavior.** Buyers, W.J.L.; Holden, T.M.; Svensson, E.C.; Lander, G.H. (Atomic Energy of Canada Ltd., Chalk River, Ontario; Argonne National Lab., Ill. (USA)). Nov 1977. Contract W-31-109-ENG-38. 12p. Dep. NTIS, PC A02/MF A01.

From International symposium on neutron inelastic scattering; Vienna, Austria (17 Oct 1977).

Highly anisotropic critical scattering associated with the transition at T/sub N/ = 49.5 K to the type-I antiferromagnetic structure has been observed in uranium nitride. The transverse susceptibility is found to be unobservably small. The longitudinal susceptibility diverges at T/sub N/ and its anisotropy shows that the spins within the (001) ferromagnetic sheets of the [001] domain are much more highly correlated than they are with the spins lying in adjacent (001) sheets. The correlation range within the sheets is much greater than that expected for a Heisenberg system with the same T/sub N/. The rod-like scattering extended along the spin and domain direction is reminiscent of two-dimensional behavior. The results are inconsistent with a simple localized model and may reflect the itinerant nature of the 5f electrons.

**21902** (NIIAR-P—250) **Experimental determination of thermal conductivity coefficient of $UO_2$ and fuel cladding contact conduction in fuel elements under reactor irradiation.** Spiridonov, Yu.G.; Tsykanov, V.A.; Samsonov, B.V.; Fomin, N.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only), PC A02/MF A01.

The procedure and results of determinations are described of the heat conductivity coefficient of uranium dioxide depending on temperature and magnitude of contact conductivity of the gas gap between the fuel rod and the fuel can. The experiments were carried out during fuel element irradiation in a research reactor. In the temperature range of 0-2800 deg C, the heat conductivity of fritted uranium dioxide (density 10.4-10.7 g/$cm^3$) with stoichiometric ratio of 2.01+-0.01 (error less than 5%) was found to be described by the equation lambdasub(t) = 55/(560+t) + 0.942x$10^{-11}$$t^3$ V/cm deg C. The obtained dependence for lambdasub(t) was used to determine the value of the contact conductivity between the fuel rod and fuel can for WWER type reactor. Also cited is the dependence of the value of contact conductivity upon specific heat load and relative diametral gap.

**21903 Effects of heat treatment on the optical and electrical properties of indium—tin oxide films.** Haines, W.G.; Bube, R.H. (Department of Materials Science and Engineering, Stanford University, Stanford, California 94305). *J. Appl. Phys.;* **49**: No. 1, 304-307(Jan 1978).

The effect of heat treatment in various environments on the electrical and optical properties of indium—tin oxide (ITO) sputtered films has been investigated. As the resistivity is decreased by heat treatment in $H_2$ from 8.3 x $10^{-3}$ to 4.3 x $10^{-4}$ Ω cm, the optical band gap increases from 3.05 to 3.42 eV consistent with a Burstein shift and intrinsic band gap of 2.98 eV, and for resistivities less than 8.3 x $10^{-4}$ Ω cm there is a rapid decrease in transmission at longer wavelengths due to free-carrier absorption and formation of dendritic precipitates. Careful control over all sputtering variables is essential to obtain reproducible properties.

**21904 Refractive index and surface layers of ceramic $(Pb,La)(Zr,Ti)O_3$ compounds.** Thacher, P.D. (Sandia Laboratories, Albuquerque, New Mexico 87115). *Appl. Opt.;* **16**: No. 12, 3210-3213(Dec 1977).

Refractive indexes of the (Pb,La)(Zr,TiO)$O_3$ system are determined by minimum deviation for eight ceramic compounds over the 400—750-nm wavelength range and for two compunds over the 25—150°C temperature range. The index of one compound (10/65/35) is reported to 2600 nm. Ellipsometric measurements show the presence of a low-index surface layer on these ceramics. Such layers, whose origin is not determined, have influenced previous index measurements based on reflection techniques.

**21905 Thermionic emission of zirconium carbide in hydrogen.** Matskevich, T.L.; Krachino, T.V. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 710-716(Jun 1977).

The residual gas can increase or reduce the thermionic emission of zirconium carbide in a vacuum of $5x10^{-9}$—$5x10^{-9}$ torr at T/sub k/=1250—1600°K. The increments can be stable and can be as large as a factor of 20. A correlation does not exist between the residual gas composition and the emission current because of the variety of processes that govern the composition and electronic state of the particles forming the surface. An exposure of $6x10^8$ langmuirs in hydrogen does not affect the thermionic emission of zirconium carbide cathodes or cathodes consisting of a solid solution of rhenium in zirconium carbide. A change in the hydrogen pressure from $1x10^{-9}$ to 0.1 torr at T/sub k/=1250—1600°K does not affect the thermionic work function of these materials and does not affect the shape of the Schottky curves. It is shown by thermal desorption that under these conditions hydrogen is adsorbed and dissolves in both zirconium carbide and a solid solution of rhenium in zirconium carbide. Adsorption of hydrogen at 1250—1600°K thus does not change the work functions of these materials. The dipole moment and charge of the hydrogen adatom on these materials are approximately zero. Small admixtures of rhenium in the zirconium carbide do not substantially affect the adsorption properties of zirconium carbide with respect to hydrogen.

**21906 Practical reasons for investigating ion transport in high temperature insulating materials.** Sonder, E. (Oak Ridge National Lab., Tenn. (USA)). *J. Phys. (Paris), Colloq.;* No. 7, C7.73-C7.78(1976).

From 2. Europhysical topical conference on lattice defects in ionic crystals; Berlin, Germany, F.R. (30 Aug - 3 Sep 1976).

Practical problems encountered in a number of advanced technology applications, particularly those related to energy conversion, are discussed. Refractory ionic compounds which are abundant and of high melting point are listed, and technological problems are discussed in terms of specific materials problems. The argument is made that basic information concerning transport properties in refractory compounds is lacking to such an extent that it is difficult to design and assess advanced energy generation systems. Technology applications include a) ceramic nuclear fuels for high temperature fission reactors, b) high temperature gas turbine blades, c) insulators in controlled thermonuclear reactors, and d) magnetohydrodynamic generators. Some of the difficulties inherent in making transport property measurements at high temperatures are also listed.

### CORROSION AND EROSION

*REFER ALSO TO CITATION(S) 21758*

## COMPOSITE MATERIALS

### PREPARATION AND FABRICATION

**21907** (N—77-26135) **Boron/aluminum fan blades for scar engines. Final report.** Stabrylla, R.G.; Carlson, R.G. (General Electric Co., Cincinnati, Ohio (USA). Aircraft Engine Group). Jun 1977. Contract NAS3-18910. 129p. (NASA-CR—135184). NTIS PC A07/MF A01.

Processing procedures were developed to enhance boron/aluminum bond behavior and foreign object damage (FOD) tolerance. Design and analysis indicated that the J101 Stage 1 fan blade meets the required frequencies without a midspan shroud. The fabricability of full size J101 blades was assessed, while six blades were fabricated and finished machined.

### MECHANICAL PROPERTIES

**21908** (N—77-26271) **Influence of temper condition on the nonlinear stress—strain behavior of boron—aluminum. Interim report, March—October 1976.** Kennedy, J.M.; Herakovich, E.T.; Tenney, D.R. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Jun 1977. Contract NGR-47-004-129. 174p. (NASA-TM-X—74753; VPI-E—77-18). NTIS PC A08/MF A01.

The influence of temper condition on the tensile and compressive stress-strain behavior for six boron—aluminum laminates was investigated. In addition to monotonic tension and compression tests, tension—tension, compression-compression, and tension--compression tests were conducted to study the effects of cyclic loading. Tensile strength results are a function of the laminate configuration; unidirectional laminates were affected considerably more than other laminates with some strength values increasing and others decreasing.

### PHYSICAL PROPERTIES

**21909 Influence of lattice defects and localized magnetic moments on the Josephson current in layered composites.** Bulaevskii, L.N.; Kuzii, V.V. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 6, 352-356(Jun 1977).

Layered crystals, both without localized magnetic states and with intercalated magnetic centers forming a two-dimensional lattice are considered under the condition that Josephson interaction between the superconducting layers is realized. It is shown that in the first case the amplitude of the Josephson current flowing between the superconducting layers, and the interaction between the layers, respectively, diminishes sharply upon "degradation" of the layered crystal structure. In the presence of magnetic centers between the superconducting layers, the amplitude of the Josephson current contains a component J/sub s/ corresponding to electron transition, between the layers through the localized magnetic states. In this case, the component J/sub s/ is considerably smaller for a disordered system of localized spins than the same component for an ordered system of localized spins.

## POLYMERS AND PLASTICS

*REFER ALSO TO CITATION(S) 21014*

### PREPARATION AND FABRICATION

**21910** (BDX—613-1691(Rev.)) **Development of an automated foam processing system. Final report.** Gallaher, J.B. (Bendix Corp., Kansas City, Mo. (USA)). Jan 1978. Contract EY-76-C-04-0613. 31p. Dep. NTIS, PC A03/MF A01.

Processing variables in the polyurethane foam encapsulation procedure on an electronic assembly timer occasionally yielded foam which was dimensionally unstable. This change in size was large enough that the affected timers would not meet gage requirements and had to be reworked. This instability was indicative of a marginal process. A thorough investigation of the problem determined that inadequate mixing of the two constituents of the foam was the cause. To eliminate the cause of the marginal process, requirements were defined which were used as guidelines in specifying the necessary equipment. This specification was then issued to suppliers for quotes. Once the quotes were received, the capabilities of the different foam processing systems were reviewed to assure conformity to the specification.

### PHYSICAL PROPERTIES

*REFER ALSO TO CITATION(S) 20975*

**21911 PVC-stabilizators.** Sweitser, D.; Klumper, L. (AKZO Chemie BV, Amersfoort (Netherlands)). *Kunststoffe;* **66**: No. 10, 667-669(1976). (In German).

One can estimate the PVC turnover in Western Europe in 1976 to have a value of 5 billion DM. The associated consumption of stabilisers, lubricants and combinations of stabilisers and lubricants can be estimated at 500 million DM. The processing of PVC without stabilisers is impossible because of the small thermal and oxidation stability of this important plastic material. The increasing uses, particularly of hard PVC and the stricter requirements by authorities regarding protection in working locations, toxicology and environmental protection have combined to determine the developments in the area of heat stabilisers for PVC in recent years. The authors report on the present state of technology and give information on future developments.

## OTHER MATERIALS

*REFER ALSO TO CITATION(S) 22056, 22061*

### PREPARATION AND MANUFACTURE

*REFER ALSO TO CITATION(S) 21273, 21274, 21276, 21278, 21286, 21300, 21913*

**21912 Laser annealing of boron-implanted silicon.** Young, R.T.; White, C.W.; Clark, G.J.; Narayan, J.; Christie, W.H.; Murakami,

M.; King, P.W.; Kramer, S.D. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Appl. Phys. Lett.;* **32**: No. 3, 139-141(1 Feb 1978).

The properties of boron-implanted silicon annealed by high-power Q-switched ruby laser radiation are compared with results obtained by conventional thermal annealing. Laser annealing of the implanted layer results in significantly increased electrical activity, as compared to thermally annealed implanted silicon. This correlates well with transmission electron microscopy and ion-channeling measurements which show a dramatic removal of displacement damage as a result of laser annealing. A substantial redistribution of the implanted boron concentration profile occurs after laser annealing which cannot be explained by thermal diffusion in the solid.

**21913 Shock synthesis of superconducting $Ta_3Si$.** Pan, V.M.; Popov, A.G.; Alekseevskii, V.P.; Kulik, O.G.; Yarosh, V.V. (Institute of Metal Physics, Academy of Sciences of the Ukrainian SSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 6, 390-392(Jun 1977).

As a result of the explosive compression of tetragonal tantalum silicide $Ta_3Si$, a superconducting modification is obtained with T/sub c/< or =8.6° K and, apparently, with the A15 structure.

### STRUCTURE AND PHASE STUDIES

**21914 One-dimensional phonons and "phase-ordering" phase transition in a Hg-As-F compound.** Hastings, J.M.; Pouget, J.P.; Shirane, G.; Heeger, A.J.; Miro, N.D.; MacDiarmid, A.G. (Brookhaven National Laboratory, Upton, New York 11973). *Phys. Rev. Lett.;* **39**: No. 23, 1484-1487(5 Dec 1977).

This paper reports elastic and inelastic neutron-scattering studies on a incommensurate linear-chain mercury compound. The one-dimensional phonon dispersion curse associated with the randomly phased linear Hg chains has been measured at room temperature. A transition, at 120 K, from a randomly phased interchain structure to a "phase-ordered" structure has been found and characterized.

### PROPERTIES

*REFER ALSO TO CITATION(S) 21190*

**21915** (MMM—2473-0422) **Thermoelectric materials evaluation program. Quarterly technical task report No. 46.** Hampl, E.F. Jr. (Minnesota Mining and Mfg. Co., St. Paul (USA). Technical Ceramic Products Div.). Feb 1976. Contract EY-76-C-02-2331. 86p. Dep. NTIS, PC A05/MF A01.

This forty-sixth Technical Task Report prepared under contract E(11-1)-2331 with the U.S. AEC and U.S. ERDA covers the performance period from October 1, 1975, to December 31, 1975. Highlights include the following tasks: N-type material development (material synthesis—gadolinium selenide compositions; material analyses; material processing; element contacting; ingradient compatibility and life testing; mechanical property characterization), TPM-217 P-type characterization (material preparation and analyses; element contacting; thermodynamic stability; isothermal chemical compatibility; ingradient compatibility and ingradient life testing; performance mapping of contacted and noncontacted elements; high-temperature partitioned P-legs), couple development (design and development of TPM-217/gadolinium selenide rare earth chalcogenide couple; design and development of TPM-217/3N-PbTe couples; advanced generator concepts), module development, liaison with Jet Propulsion Laboratory and material supply, liaison with GGA, and program management. 24 figures, 27 tables. (RWR)

### RADIATION EFFECTS

*REFER ALSO TO CITATION(S) 21195*

**21916 Tunable-laser-induced grating dip for measuring sub-picosecond relaxation.** Keilmann, F. (Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (Germany, F.R.)). *Appl. Phys.;* **14**: No. 1, 29-33(Aug 1977).

This paper describes the experimental verification of a laser-induced double-dip resonance predicted theoretically for two-wave saturation spectroscopy. Fine structure in the form of a central dip with a width (FWHM) near 20 $cm^{-1}$ is found in the broad hole-burning feature induced by 942 $cm^{-1}$ wavelength radiation in p-type germanium. The central dip is ascribed to Bragg scattering caused by, and thus measuring the decay of, the excited-state population grating set up by interference of the saturating and the probing waves. From the composite spectrum, therefore, a population difference lifetime $T_1 = 0.6$ ps can be directly obtained as the inverse width of the central dip. Likewise the broad background feature yields the homogeneous or dipole lifetime $T_2 = 0.1$ ps.

# CHEMISTRY

## ANALYTICAL AND SEPARATIONS CHEMISTRY

*REFER ALSO TO CITATION(S) 21053, 22143, 22154, 22286*

**21917** (N—77-27053) **Lunar sample studies.** (National Aeronautics and Space Administration, Houston, Tex. (USA). Lyndon B. Johnson Space Center). 1977. 72p. (NASA-SP—418). NTIS PC A04/MF A01.

Lunar samples discussed and the nature of their analyses are: (1) an Apollo 15 breccia which is thoroughly analyzed as to the nature of the mature regolith from which it derived and the time and nature of the lithification process, (2) two Apollo 11 and one Apollo 12 basalts analyzed in terms of chemistry, Cross-Iddings-Pirsson-Washington norms, mineralogy, and petrography, (3) eight Apollo 17 mare basalts, also analyzed in terms of chemistry, Cross-Iddings-Pirsson-Washington norms, mineralogy, and petrography. The first seven are shown to be chemically similar although of two main textural groups; the eighth is seen to be distinct in both chemistry and mineralogy, (4) a troctolitic clast from a Fra Mauro breccia, analyzed and contrasted with other high-temperature lunar mineral assemblages. Two basaltic clasts from the same breccia are shown to have affinities with rock 14053, and (5) the uranium-thorium-lead systematics of three Apollo 16 samples are determined; serious terrestrial-lead contamination of the first two samples is attributed to bandsaw cutting in the lunar curatorial facility.

**21918** (UCID—15644-77-3) **General Chemistry Division quarterly report, July—September 1977.** Harrar, J.E. (ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Nov 1977. Contract W-7405-ENG-48. 43p. Dep. NTIS, PC A03/MF A01.

Analytical research and development work is reported on multielement analysis, time-resolved spectroscopy, fluorescence analysis, ionization potential of NP, excited state chemistry, polarized x ray sources, potentiometric titration of Na, determination of TATB in DMSO, determination of nitrobenzene in TATB, analysis of explosive composites, mass spectrometer automation, mass spectra calculation, solids formation in geothermal brine, water quality laboratory automation, aerosol coagulation, and multiple-gas analyzers. (JRD)

### ACTIVATION AND NUCLEAR REACTION PROCEDURES

*REFER ALSO TO CITATION(S) 20887, 20888, 21229, 21230, 21234, 21412, 21973, 22244*

**21919 Application of neutron activation analysis to coal research.** Ruch, R.R.; Cahill, R.A.; Frost, J.K. (Illinois State Geological Survey, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 159(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21920 Instrumental neutron activation analyses for the NURE hydrogeochemical reconnaissance survey.** Smith, C.F. (Univ. of California, Livermore). *Trans. Am. Nucl. Soc.;* **27**: 159-160(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21921 Fast-neutron activation analysis in coal research.** Volborth, A.; (North Dakota State Univ., Fargo); Miller, G.E. *Trans. Am. Nucl. Soc.;* **27**: 160-161(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21922 System optimization for prompt-neutron activation analysis of coal.** Reynolds, G.M.; Maung, T.; Orphan, V.J.; Gozani, T.; Elias, E.; Bozorgmanesh, H. (Science Applications, Inc., Albuquerque, NM). *Trans. Am. Nucl. Soc.;* **27**: 161-162(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21923 Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products.** Filby, R.H. (Washington State Univ., Pullman)( Carpenter, B.S. *Trans. Am. Nucl. Soc.;* **27**: 162-163(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21924 Beryllium-reflected coal analytical assembly using $^{252}Cf$ neutron-capture gamma rays.** Duffey, D. (Univ. of Maryland, College Park); O'Fallon, N.; Herzenberg, C.; Doering, R.W.; Wiggins, P.F. *Trans. Am. Nucl. Soc.;* **27**: 163-164(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21925 Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean.** Robertson, D.E. (Battelle Northwest Labs., Richland, WA). *Trans. Am. Nucl. Soc.;* **27**: 170-172(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21926 Uranium analysis of natural waters by fission tracks.** Carpenter, B.S. (U.S. Geological Survey, Denver); Reimer, G.M. *Trans. Am. Nucl. Soc.;* **27**: 172-173(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21927 Determination of bismuth by photon activation analysis.** Lutz, G.J.; Sato, N. (National Bureau of Standards, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 216-217(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21928 Advance prediction of neutron activation analysis spectra and detection limits.** Guinn, V.P.; Leslie, J.C.; Murray, L.E. (Univ. of California, Irvine). *Trans. Am. Nucl. Soc.;* **27**: 218-219(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## CHEMICAL PROCEDURES

*REFER ALSO TO CITATION(S) 20893, 20894, 21007, 21945*

**21929 Spectroscopic element detector for gas chromatography.** Feldman, C.; Batistoni, D.A. (Oak Ridge National Lab., TN). *Anal. Chem.;* **49**: No. 14, 2215-2221(Dec 1977).

A simple helium glow discharge detector with a stable but inexpensive power supply has been used to detect individual halogens, S, P, C, and metals in GC effluents. Glow chamber design prevents degradation products from coating the observation window. The monochromator is provided with an internal beam-splitter and a side-exit port. A movable exit slit mounted on the latter permits background corrections to be made at the most suitable distance from the elemental line detected. Selectivity and versatility are greatly improved by this type of background detection.

**21930 Cd ion activity in soils: evaluation of Cd ion-selective electrode.** Jackson, D.R.; Bondietti, E.A. (Oak Ridge National Lab., TN). *Environ. Sci. Technol.;* **11**: 585-587(Jun 1977).

Cadmium ion activity was measured in 0.05 M $Ca(NO_3)_2$ extracts of two soils containing up to 100 ppM Cd. Comparative analyses by atomic absorption spectroscopy showed excellent agreement with the electrode method ($r = 0.99$, $b = 1.03$), suggesting the bulk of soluble Cd in solution was $Cd^{2+}$ ions. Interference phenomena associated with the electrode were characterized. Cleaning the electrode by machine buffing and/or washing in EDTA was necessary for reproducible readings. Interference in soil extracts was primarily due to loosely adsorbed Cd, Pb, Cu, and Zn ions on the electrode surface. The detection limit of the electrode in soil extracts was 0.05 μg Cd/mL. The electrode cannot be used for analysis of soils containing highly concentrated $Pb^{2+}$, $Hg^{2+}$, $Cu^{2+}$, or $Ag^{+}$.

**21931 (BNWL-tr—279) Concentration and quantitative determination of trace volatile fatty acids in water by liquid chromatography with thermal detector.** Horikawa, K. Translated from *Jpn. Anal.;* **21**: 806-808(1972). 7p. Dep. NTIS, PC A02/MF A01.

An attempt was made to analyze volatile fatty acids in water by liquid chromatography of the thermal detection system, and it was learned that, in the method of determination by concentrating a dilute solution, concentration can be performed by the simple method of increasing the amount of the sample injected. This is an effective method which utilizes the separating and concentration action of ion-exchange chromatography. Quantitative determination of several ppM of formic, acetic, and propionic acids in water can be carried out quickly.

## RADIOMETRIC AND RADIOCHEMICAL PROCEDURES

*REFER ALSO TO CITATION(S) 20897, 22143, 22152, 22154, 22201*

**21932 Rapid simultaneous determination of sulfur and vanadium in crude oil using X-ray fluorescence.** Yousif, A.N.; Al-Shahristani, H. (Iraq Atomic Energy Commission, Baghdad. Nuclear Research Inst.). *Int. J. Appl. Radiat. Isot.;* **28**: No. 9, 759-763(Sep 1977).

A rapid instrumental method for simultaneous determination of sulfur and vanadium in crude oil by X-ray fluorescence using radioisotope exciting radiations and a semiconductor detector is discussed. Changes in crude oil density or composition did not affect the sulfur determination, while the vanadium concentration measurement was influenced by the sulfur content of the oil. Crude oil samples were taken from different Iraqi fields and analysed by this method.

**21933 Method and apparatus for determining uranium concentration in a moving stream.** Bartko, J.; Wonn, J.W. (to Westinghouse Electric Corp.). US Patent 4,043,755. 23 Aug 1977. Filed date 29 Mar 1976. 6p.

The concentration of uranium in a moving stream is determined by agglomerating background microbubbles out of the 6 to 10 micron size range, counting microbubbles in the stream which are about 6 to about 10 microns in size, exposing the stream to a radiation source to cause uranium fission fragments to produce microbubbles, counting microbubbles which are about 6 to about 10 microns in size, and subtracting one count from the other and multiplying by a calibration constant. The subtraction can be performed on an earlier first count so that both counts are made on the same volume. The radiation exposure can be automatically increased when the difference between the first and second counts is low.

**21934 Radioisotopic x-ray analysis of uranium ores using Compton scatter for matrix compensation.** Rowson, J.W.; Hontzeas, S.A. (Regina Univ., Saskatchewan (Canada)). *Can. J. Spectrosc.;* **22**: No. 1, 24-30(Jan 1977).

An x-ray fluorescence analysis system has been designed for the quantitative determination of uranium in uranium bearing ores. $MoK\alpha_1\alpha_2$ secondary radiation at 17.48 and 17.37 keV selectively excites only the uranium $L_{III}$ subshell. A technique usng the uranium fluorescence to Compton scatter ratio to provide adequate compensation for absorption and enhancement effects is described. Application of this technique gave a calibration curve which is linear in concentration of $U_3O_8$ for four orders of magnitude. The results presented are favourably compared with those obtained by a fluorimetric technique.

**21935 X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts.** Schultz, A.J. (Univ. of Illinois, Urbana); Stucky, G.D.; Williams, J.M.; Koch, T.R Maffly, R.L. *Solid State Commun.;* **21**: No. 2, 197-200(1977).

We have observed and measured the x-ray diffuse scattering from several new partially oxidized tetracyanoplatinate, TCP, complexes. In all cases it is found that the superlattice associated with the diffuse sheets corresponds to the 2k/sub F/ wavevector derived from the chemical formula. The compounds which were prepared and studied are the cation deficient salts $M_{1.75}[Pt(CN)_4] \cdot xH_2O$,M(def)TCP (M = K, Rb, Cs), where the $Rb^+$ and $Cs^+$ salts are newly synthesized, and the anion deficient guanidinium salt $[C(NH_2)_3]_2[Pt(CN)_4]Br_{0.23} \cdot H_2O$, GCP(Br).

**21936 Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples.** Fabbi, B.P. (U.S. Geological Survey, Denver). *Trans. Am. Nucl. Soc.;* **27**: 203(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21937 Recent advances in energy-dispersive XRF analysis of aerosol samples.** Dzubay, T.G. (U.S. Environmental Protection Agency, Montgomery, AL). *Trans. Am. Nucl. Soc.;* **27**: 203-204(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21938 Recent developments in instrumentation for wavelength-dispersive x-ray analysis.** Croke, J.F. (Philips Electronic Instruments, Mahwah, NJ). *Trans. Am. Nucl. Soc.;* **27**: 205(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21939 Polarized radiation for XRF of elements with Z=47-57.** Kaufman, L.; Shosa, D. (Univ. of California, San Francisco); Camp, D. *Trans. Am. Nucl. Soc.;* **27**: 205-206(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21940 Proton-induced x-ray emission multielement analysis in biomedical, environmental, geological, and archaeological specimens.** Fink, R.W. (Georgia Inst. of Tech., Atlanta). *Trans. Am. Nucl. Soc.;* **27**: 206-208(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21941 Uranium assay of phosphate fertilizers and other phosphatic materials.** Bouwer, E.J.; McKlveen, J.W. (Arizona State Univ., Tempe); McDowell, W.J. *Trans. Am. Nucl. Soc.;* **27**: 214-215(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### SPECTRAL PROCEDURES

*REFER ALSO TO CITATION(S) 20874, 20894, 21930*

**21942 (IS-T—741) Investigations of several interference effects in high frequency plasmas of analytical importance.** Larson, G.F. (Ames Lab., Iowa (USA)). Feb 1977. Contract W-7405-ENG-82. 142p. Dep. NTIS, PC A07/MF A01.

Investigations of the extent to which certain inter-element or interference effects occur in a radiofrequency-excited inductively coupled plasma (ICP) are reported. Under conditions normally employed for analytical purposes, it is shown that: (a) two solute vaporization interferences often observed in flames are eliminated or reduced to negligible proportions in the plasma; (b) increasing concentrations of an easily ionizable element (Na) up to concentrations of 6900 μg/ml exerted an unusually low influence on the observed emission intensities of three selected elements (Ca, Cr, and Cd) of widely differing degrees of ionization. The high degree of freedom from interelement effects of this analytical technique is further documented by the observation that a variety of matrices did not affect the emission intensity of Mo to a significant extent. A comparison of the degree to which several interference effects are observed in a microwave-excited single electrode plasma (SEP) and in an ICP shows that the severe changes observed in the SEP are small or negligible in the ICP. The spectral interferences arising from stray light and from the wings of broadened emission lines in atomic emission spectrometry are discussed. Experimental evidence is presented showing various forms of stray light originating from defects in the optical components, design and engineering of optical spectrometers. Experimental evidence is also presented demonstrating that the wings of certain spectral lines emitted by high temperature sources may contribute a significant continuum at wavelengths as far removed as 10 nm or more from the line center.

**21943 Deconvolution and background subtraction by least-squares fitting with prefiltering of spectra.** Statham, P.J. (Univ. of California, Berkeley). *Anal. Chem.;* **49**: No. 14, 2149-2154(Dec 1977).

Deconvolution of overlapped peaks in a spectrum is complicated by the presence of a high background component. A method of background subtraction, which involves suppressing the background in both the specimen data and peak models with a digital filter before proceeding to a conventional least-squares fit, is analyzed. The dimensions of a "top-hat" filter are found which give a suitable compromise with regard to statistical accuracy and sensitivity to both background curvature and possible errors in the peak models. The major advantages over conventional techniques are that the shape of the background need not be known explicitly, there is no need to find suitable points away from peaks for background scaling, and any background that is approximately linear over the range covered by a single peak will be effectively removed.

### SEPARATION PROCEDURES

*REFER ALSO TO CITATION(S) 21155*

**21944 Mass transfer characterization of Donnan dialysis.** Lake, M.A.; Melsheimer, S.S. (Clemson Univ., SC). *AIChE J.;* **24**: No. 1, 130-137(Jan 1978).

Donnan dialysis is a relatively new ion exchange process using ion exchange membranes to permit continuous operation. Potential applications exist in many areas where traditional columnar ion exchange, requiring a regeneration cycle, is currently used. A mathematical model was developed. Mass transfer parameters for the model were determined from laboratory data and correlated with the system operating variables.

**21945 Selective concentration of amines from aqueous solutions by a gas purging technique.** Chriswell, C.D.; Fritz, J.S. (Ames Lab., IA). *J. Chromatogr.;* **136**: 371-377(1977).

Amines are removed from heated, basic solutions saturated with salt by inert gas stripping and selectively trapped as coordination complexes on columns containing copper(II) salts coated on an inert support. An estimate of the amine concentrations at ppM levels can be made by measuring the length of the trapping column colored by the complexes. Concentrations of amines in ppB can be determined by eluting this column with potassium hydroxide and determining the amines in the effluent directly by gas chromatography. The procedure allows amines to be concentrated by a factor of 200 and removes potentially interfering substances from the sample.

## INORGANIC AND PHYSICAL CHEMISTRY

*REFER ALSO TO CITATION(S) 22068*

**21946 Hydrolysis of manganeous chloride.** Bamberger, C.E.; Richardson, D.M. (Oak Ridge National Lab., TN). *J. Inorg. Nucl. Chem.;* **39**: 150-151(1977).

A study of proposed mechanisms for the hydrolysis of $MnCl_2$ based on free-energy changes indicated that the most likely reaction is: $MnCl_2 + H_2O$ yields $MnO + 2HCl$. This hydrolysis reaction was tested experimentally, and the results indicated that the proposed reaction does indeed describe the hydrolysis reaction. (BLM)

### CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

*REFER ALSO TO CITATION(S) 21976, 21978, 22309*

**21947 (LBL—6699) Chemical applications of molecular quantum theory.** Ungemach, S.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1977. Contract W-7405-ENG-48. 158p. Dep. NTIS, PC A08/MF A01.

Thesis.

Molecular systems of chemical interest are investigated with the aid of molecular quantum theory. The self-consistent field (SCF) method is used to predict the molecular structures of $ClF_2$, $ClF_4$ and $Cl_3$ radicals, and the ions $ClF_2^+$, $ClF_2^-$, $ClF_4^+$ and $ClF_4^-$. The $ClF_2$ and $Cl_3$ radicals are predicted to be bent with bond angles of 145.2° and 158.6°, respectively, while the ions $ClF_2^+$ and $ClF_2^-$ are predicted to be bent with a bond angle of 97.4° and linear, respectively. The geometry predictions for the $ClF_4$ radical and the $ClF_4^+$ ion are found to be notably basis set dependent. The $ClF_4^-$ ion is predicted to be square-planar. Multi-configuration self-consistent field (MCSCF) calculations have yielded the dipole moment function for the $^1$sigma$^+$ state of HI, which qualitatively confirms the experimental finding that the dipole derivative at R/sub e/ is negative. The $^2$sigma$^+$ $F + H_2$ potential energy surface is studied extensively with the configuration interaction (CI) method. The most complete calculations yield an activation energy of 2.74 kcal/mole and an exothermicity of 30.0 kcal/mole. The production of a potential energy surface of "chemical accuracy" for this system is found to be more difficult than previously believed. The simplest hydrophobic model, the water-methane system, is studied with the SCF method in order to determine the nature and magnitude of the interaction. The most favorable geometric arrangement corresponds to an attraction of 0.5 kcal/mole.

**21948 (ORO—1797-76) Studies of the hydrogen bonded structures of water and methanol.** Choppin, G.R. (Florida State Univ., Tallahassee (USA). Dept. of Chemistry). 1977. Contract EY-76-S-05-1797. 24p. (CONF-770957—1). Dep. NTIS, PC A02/MF A01.

From 13. European congress on molecular spectroscopy; Wroclaw, Poland (12 Sep 1977).

The vibrational spectra of liquid water and of aqueous solutions show marked effects with variations in temperature and solute concentration. A review is given of studies made in which the spectra of a variety of aqueous systems were analyzed using the model of three spectroscopically distinguishable species. The extension of these studies to higher temperatures and to the non-aqueous hydrogen bonded solvent methanol is described. Assignments were made of the vibrational spectra bands, and the percent hydrogen bonding was calculated as a function of temperature. (JSR)

**21949 Reaction and deactivation of HCl (v=1, 2) by O atoms.** Macdonald, R.G.; Moore, C.B. (Department of Chemistry, University of California, and Materials and Molecular Research Division of the Lawrence Berkeley Laboratory, Berkeley, California 94720). *J. Chem. Phys.;* **68**: No. 2, 513-521(15 Jan 1978).

Laser-induced fluorescence, following direct excitation of HCl (v=2), was used to measure the total deactivation rate constant

for HCl (v=2) by O($^3$P/sub g/) atoms as (5.2 +- 0.4) x $10^{-12}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$. This is partitioned into a reaction rate constant of (1.5 +- 1.2) x $10^{-12}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$ for HCl (v=2)+O($^3$P/sub g/) →OH (v=1, 0)+Cl and a relaxation rate constant for HCl (v=2)+O($^3$P/sub g/) →HCl (v=1)+O($^3$P/sub g/) of (3.7 +- 1.2) x $10^{-12}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$. The total deactivation rate constant for HCl (v=1)+O($^3$P/sub g/) atoms, including reaction and relaxation, was measured to be (8.9 +- 1.3) x $10^{-13}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$. All measurements were carried out at 296 +- 2 °K. The vibrationally enhanced chemical reaction rate constant for HCl (v=2) is roughly a factor of $10^4$ greater than the reaction rate constant for HCl (v=0) with O atoms. The reaction appears to occur adiabatically on the lowest triplet potential hypersurface. For HCl (v=2, 1)+O vibrational relaxation is faster than chemical reaction even though the total energy is well above the barrier to reaction.

**21950 Negative ion chemistry of (eta$^5$-$C_5H_5$)Co(CO)$_2$ in the gas phase by ion cyclotron resonance spectroscopy. The π-acceptor ability of $PF_3$ compared to CO.** Corderman, R.R.; Beauchamp, J.L. (California Inst. of Tech., Pasadena). *Inorg. Chem.;* **16**: No. 12, 3135-3139(Dec 1977).

The gas-phase negative ion chemistry of (eta$^5$-$C_5H_5$)Co(CO)$_2$ is studied using the techniques of ion cyclotron resonance spectroscopy. Attachment of trapped electrons leads to the formation of cyclopentadienylcobalt dicarbonyl and monocarbonyl, $CpCo(CO)^-_2$ and $CpCo(CO)^-$. While the molecular anion is unreactive, $CpCo(CO)^-$ reacts with the neutral precursor to yield $[CpCo(CO)]_2^-$, which has been previously characterized in solution. The first observed example of a ligand displacement reaction involving an anionic transition-metal complex, in which $PF_3$ displaces CO from $CpCo(CO)^-$, is reported and leads directly to the conclusion that $PF_3$ is a stronger π-acceptor ligand than CO toward $CpCo^-$ in the gas phase. Nitric oxide reacts with both $CpCo(CO)^-$ and $CpCo(CO)_2^-$ to yield the very stable anion $CpCo(NO)^-$, which is isoelectronic with CpNiNO. π acids weaker than CO ($C_2F_4$, HCN, ethylene oxide, MeCN, $NH_3$, $NMe_3$, and $PMe_3$) were not observed to react with $CpCo(CO)^-$. The relative contribution of sigma and π bonding in the metal-ligand bonds of $CpCoB^-$ and $CpNiB^+$ is discussed. Reactions of the anions $F^-$ and $CD_3O^-$ with $CpCo(CO)_2$ are briefly considered.

**21951 High-precision neutron diffraction investigation of the prototype biscyclopentadienyl transition metal hydride (eta$^5$-$C_5H_5$)$_2MoH_2$ and resolution of the structure in terms of modern bonding theory.** Schultz, A.J.; Stearley, K.L.; Williams, J.M.; Mink, R.; Stucky, G.D. (Argonne National Lab., IL). *Inorg. Chem.;* **16**: No. 12, 3303-3306(Dec 1977).

A high-precision single-crystal neutron diffraction determination of the crystal and molecular structure of (eta$^5$-$C_5H_5$)$_2MoH_2$ has been carried out in order to resolve previous x-ray and neutron diffraction studies which produced structural models which are inconsistent with modern bonding theories. The complex crystallizes in space group C2/c with cell parameters of a = 14.311 (7) A, b = 5.905 (3) A, c = 10.440 (5) A, $\beta$ = 104.15 (2)°, and Z = 4. Intensity data were measured for two independent octants out to (sin theta)/lambda = 0.72. The structure was solved by direct methods and refinement led to final discrepancy indices of $R(F_o^2)$ = 0.074 and R/sub w/($F_o^2$) = 0.101. The dihedral angle between the two cyclopentadienyl planes is 34.2°, and the C—C bond lengths within each ring are indicative of a completely delocalized π system. The coordinates of the metal-bonded hydrogen atom have been unequivocally located and refined, and a Mo—H distance of 1.685 (3) A and a H—Mo—H′ angle of 75.5 (3)° has been obtained. The new structural parameters determined for (eta$^5$-$C_5H_5$)$_2MoH_2$ are substantially different from those previously reported but are in excellent agreement with those predicted today for transition metal cyclopentadienyl hydrides.

**21952 Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn—Teller distortion.** Templeton, J.L.; Jacobson, R.A.; McCarley, R.E. (Ames Lab., IA). *Inorg. Chem.;* **16**: No. 12, 3320-3328(Dec 1977).

Oxidative bromination of $[(C_3H_7)_4N]^+W(CO)_5Br^-$ with 1,2-dibromoethane in refluxing chlorobenzene afforded the new compound $[(C_3H_7)_4N]_2W_2Br_9$ in high yield. Material obtained after recrystallization from acetonitrile showed simple Curie-law magnetic susceptibilities over the range 77 to 300°K with a magnetic moment of 1.72 μ/sub B/. The crystals were found to be monoclinic with lattice constants a = 36.42 (2) A, b = 12.067 (8) A, c = 19.62 (1) A, and $\beta$ = 95.90 (2)°, space group C2/c, d(calcd) = 2.26 g $cm^{-3}$, d(obsd) = 2.31 g $cm^{-3}$ with eight molecules per unit cell. Using 2255 reflections with I greater than or equal to 3 sigma$_I$ the structure was refined to R = 0.050 and R/sub w/ = 0.063. The $W_2Br_9^{2-}$ anion was found to have a confacial bioctahedral structure with d(W—W) = 2.601 (2) A consistent with the expected W—W bond order of 2.5. An interesting distortion of the anion from D/sub 3h/ symmetry was manifested as an effective 3° rotation of each of the planes formed by the three terminal bromine atoms on each tungsten toward the same bridging bromine atom. In this manner the real symmetry of the anion is lowered to C/sub 2 upsilon/. Consideration of packing effects, intramolecular nonbonded interactions, and metal-metal bonding led to the conclusion that the distortion arises from electronic effects, viz., separation of the e′ metal-metal π orbitals as dictated by the Jahn-Teller theorem.

**21953 Coordination chemistry guide to structural studies of chemisorbed molecules.** Muetterties, E.L.; Hemminger, J.C.; Somorjai, G.A. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 12, 3381-3385(Dec 1977).

In an effort to further the understanding of surface chemistry at the molecular level, various classes of chemisorbed states for molecules are described. Six general classes of chemisorption processes discussed are: (1) molecular association, (2) molecular dissociative and reversible, (3) thermal desorption, (4) molecular dissociative and completely irreversible, (5) associative polymerization, and (6) dissociative polymerization. In addition to the six classes of chemisorption processes, three classes of chemisorption states discussed are: (1) a state in which the molecule undergoes substantial rehybridization, (2) a state in which the molecule rearranges to a new molecule, and (3) a state in which the molecule rearranges to a molecular fragment. These types of chemisorption processes and states are summarized with their chemical characteristics in tabular form, and an extensive bibliography is included. (BLM)

**21954 Direct calculation of the equilibrium value of the energy of activation for dissociation of $H_3$ by Ar and evidence for the important contribution of collisional dissociation from low vibrational quantum numbers and high rotational quantum numbers at shock tube temperatures.** Truhlar, D.G. (Univ. of Minnesota, Minneapolis); Blais, N.C. *J. Am. Chem. Soc.;* **99**: No. 24, 8108-8109(23 Nov 1977).

A quasi-classical trajectory study was made of the relative contribution to the dissociation rate of collisions with various initial vibrational quantum numbers of para-$H_2$ dilute in Ar under conditions of local equilibrium of reactants at 4500°K. Large contributions are found from low vibrational quantum numbers. Since vibrational nonequilibrium effects will tend to decrease the relative contribution of high vibrational collisions, this implies even larger contributions from low-vibrational collisions for a rotationally equilibrated, vibrationally nonequilibrated steady state. E/sub a/ at equilibrium was calculated at 6 kcal $mol^{-1}$ below $D_0$. (JSR)

**21955 Synthetic, structural, and magnetic properties of the pyrazine-bridged lanthanide organometallic complex μ-pyrazine-bis[tris(cyclopentadienide)ytterbium (III)], $(C_5H_5)_3Yb(NC_4H_4N)Yb(C_5H_5)_3$.** Baker, E.C.; Raymond, K.N. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 11, 2710-2714(Nov 1977).

The synthesis, characterization, and structural and magetic properties of the title compound are reported. The reaction of $Yb(C_5H_5)_3$ with pyrazine under inert atmosphere conditions in benzene gives the dinuclear product. Slow sublimation under vacuum begins at 75°C and gives green-brown crystals. The structure has been determined from three-dimensional x-ray diffraction data collected by counter methods. The molecular unit is located about a crystallographic inversion center. Two ytterbium atoms, each with three eta$^5$-cyclopentadienide rings, are nearly linearly bridged by a pyrazine ring coordinated through its nitrogens. The ytterbium-nitrogen distance is 2.61 A and the average ytterbium-carbon distance is 2.68 (1) A. The coordination about the ytterbium is nearly C/sub 3 nu/ in symmetry. The crystals conform to space group C2/c with a = 14.006 (5) A, b = 8.299 (3) A, c = 24.637 (9) A, $\beta$ = 102.83 (1)°, Z = 4, and rho/sub calcd/ = 1.94 g/$cm^3$. A total of 4857 reflections were collected of which 1304 independent reflections with $F^2$ equal to or greater than 3 sigma($F^2$) were used in the final refinement to give a weighted R factor of 4.5%. The magnetic susceptibility of the title compound has been measured in the range 3 to 100 K and shows linear Curie-Weiss behavior with C = 1.51 (4), theta = 1.3 (6) K, and μ/sub eff/ = 3.48 μ/sub B/. There is no evidence of any magnetic interaction between metal centers or reduction of magnetic moment due to f-orbital covalency. This lack of interaction and the consistency of the $MCp_3$ bonding parameters in both lanthanide and actinide compounds make an ionic formulation of the bonding most appropriate, in contrast to some previous suggestions for related compounds.

**21956 Crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ and $Cd_3[Co(CN)_6]_2.12H_2O$ by neutron and x-ray diffraction.** Beall, G.W.; Milligan, W.O.; Korp, J.; Bernal, I. (Baylor Univ., Waco, TX). *Inorg. Chem.;* **16**: No. 11, 2715-2718(Nov 1977).

The crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ has been determined by neutron and x-ray diffraction methods and that of $Cd_3[Co(CN)_6]_2.12H_2O$ by the latter method. In both cases, the space group is Fm3M with lattice constants of 10.436 (3) and 10.600 (3) A, respectively. The structure is disordered and contains 1.33 formula weights per unit cell. The only atom that is not disordered is the manganese or cadmium atom. The structure is held together by cyanide links between the cobalt atom and manganese or cadmium atom. Eight of the water molecules (24c in the unit cell) are coordinated to the manganese or cadmium atom, and the other eight

water molecules are of two types. The first type (2.66 molecules) in the 8c (1/4, 1/4, 1/4) position is contained in holes and not hydrogen bonded to any other water molecules. The second type (5.33 molecules) in position 32f (0.16, 0.16, 0.16) is hydrogen bonded to the coordinated water molecules. The final R values are 8.8, 7.2, and 4.3%, and R/sub w/ values are 7.4, 8.8, and 5.5%, respectively, for Mn (neutron), Mn (x ray), and Cd (x ray). Dehydration studies were also made on single crystals of $Mn_3[Co(CN)_6]_2.12H_2O$.

**21957 Trans effects in octahedral complexes: substitution of chloromethyl- and dichloromethylpentaaquochromium(III) ions by thiocyanate ion.** Bushey, W.R.; Espenson, J.H. (Ames Lab., IA). *Inorg. Chem.;* **16**: No. 11, 2772-2776(Nov 1977).

Equilibrium and kinetic data were evaluated for formation of the 1 : 1 complexes of $NCS^-$ with $(H_2O)_5CrCh_2Cl^{2+}$ and $(H_2O)_5CrCHCl_2^{2+}$. Equilibrium is established within less than 100 s, which is unusually rapid for Cr(III) substitution. This corresponds to replacement of only a single $H_2O$ molecule for both $NCS^-$ and $Ch_3OH$ as entering groups, verified for $NCS^-$ by species tests and equilibrium constant determinations and for $CH_3OH$ by chemical analysis. The formation constants for $NCS^-$ are 10.4 and 12.8 $M^{-1}$ for $CrCH_2Cl^{2+}$ and $CrCHCl_2^{2+}$, respectively. The kinetic data for anation follow the expression k/sub an/ = A[$NCS^-$]/(1 + C[$NCS^-$]) and are consistent with both a limiting S/sub N/1 and an ion-pairing mechanism.

**21958 Kinetic study of the hydrolysis of 2-germaacetate in neutral and alkaline solutions.** Yang, D.J.; Jolly, W.L. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 11, 2834-2837(Nov 1977).

In neutral and alkaline solutions, the 2-germaacetate ion decomposes to give germane and bicarbonate (or carbonate): $GeH_3CO_2^-$ + $H_2O$ yields $GeH_4$ + $HCO_3^-$. The rate of this decarboxylation is pH independent and is first order in the germaacetate ion. The rate constant at 60°C and ionic strength 1.0 is 1.62 x $10^{-5}$ $s^{-1}$; the activation energy is 28.6 kcal/mol. In strongly alkaline solutions (especially at hydroxide concentrations above 1 M), a second decomposition reaction, producing hydrogen and the insoluble brown polymer $H_2Ge_2O_3$ . $xH_2O$, competes with the decarboxylation: $2GeH_3CO_2^-$ + $2OH^-$ + (3 + x)$H_2O$ yields $6H_2$ + $H_2Ge_2O_3$ . $xH_2O$ + $2CO_3^{2-}$. The rate of the latter reaction is first order in germaacetate ion and is inversely proportional to the Hammett acidity function h, i.e., first order in hydroxide ion; -d ln ($GeH_3CO_2^-$)/dt = k($OH^-$). At 60°C, k = 2.0 x $10^{-5}$ $M^{-1}$ $s^{-1}$; the activation energy is 20.8 kcal/mol. Probable mechanisms of the reactions are discussed.

**21959 Reaction of fluorine and hypofluorous acid with some substitution-inert complex ions in aqueous perchloric acid solutions.** Thompson, R.C.; Appelman, E.H.; Sullivan, J.C. (Argonne National Lab., IL). *Inorg. Chem.;* **16**: No. 11, 2921-2926(Nov 1977).

This paper examines the reactions of $F_2$ and HOF with aqueous perchloric acid solutions containing various complexes of trivalent chromium. In no case is the chromium itself oxidized. The complex $CrF^{2+}$ is unreactive toward either oxidant. $CrClO_3^{2+}$, $CrNO^{2+}$, $CrCl^{2+}$, and $CrBr^{2+}$ show increasing reactivity, with the formation of $Cr^{3+}$ as the principal product. In the case of $CrBr^{2+}$ and $CrCL^{2+}$ there is evidence that $F_2$ can react with the substrate directly, as well as via the intermediate formation of HOF. This direct reaction produces some $CrF^{2+}$ in addition to $Cr^{3+}$. Azidochromium(III), $CrN_3^{2+}$, is the most reactive of the complexes studied. It reacts directly with $F_2$ to form a mixture of $Cr^{3+}$ and $CrF^{2+}$; it reacts with HOF to form $CrNO^{2+}$. Reaction mechanisms that can account for these observations are discussed.

**21960 Nuclear magnetic resonance study of the structure in solution of lanthanide complexes with benzene-1,2-dioxydiacetate.** Kullberg, L.; Choppin, G.R. (Florida State Univ., Tallahassee). *Inorg. Chem.;* **16**: No. 11, 2926-2931(Nov 1977).

The induced shifts of $^1H$ and $^{13}C$ nuclei in the ligand benzene-1,2-dioxydiacetate complexed by $Pr^{3+}$, $Eu^{3+}$, and $Yb^{3+}$ have been measured. From the ratios of the shifts, the relative extent of contact and dipolar contributions to the shifts has been estimated. The dipolar shifts were used with the McConnell-Robertson equation to calculate the internuclear distances and angles of 1 : 1 and 1 : 2 complexes.

**21961 Thermodynamic properties of lanthanide complexes with benzene-1,2-dioxydiacetic acid.** Hasegawa, Y.; Choppin, G.R. (Florida State Univ., Tallahassee). *Inorg. Chem.;* **16**: No. 11, 2931-2934(Nov 1977).

The free energies, enthalpies, and entropies of complexation of lanthanide ions by benzene-1,2-dioxydiacetate have been determined by potentiometry, calorimetry, and solvent extraction. Comparison of the entropy values with those of analogous complexes involving bi-, tri-, and tetradentate diacetate ligands gives an entropy change of ca. 95 +- 10kJK$^{-1}$ mol$^{-1}$ per carboxylate group. This correlation was used to obtain a relative measure of the Lewis basicity of the other ligand donor sites (oxo, imino, thio). The lanthanide cations do not interact with the thio donors while the order with the oxo and imino donors is $(-CH_2NCH_2CO_2^-)_2$ greater than $N(CH_2CO_2^-)_2$ equal to or greater than $O(CH_2CO_2^-)_2$ greater than $(-CH_2OCH_2CO_2^-)_2$ greater than $Ph(OCH_2CO_2^-)_2$.

**21962 Moessbauer spectra of Np(V)—Cr(III) and Np(V)—Rh(III) complexes.** Karraker, D.G.; Stone, J.A. (E.I. du Pont de Nemours and Co., Aiken, SC). *Inorg. Chem.;* **16**: No. 11, 2979-2980(Nov 1977).

Complexes of Np(V)-Cr(III) and Np(V)-Rh(III) were prepared, and the complexes were separated from the uncomplexed ions by ion exchange. The Mossbauer spectral study of these complexes is reported. A structure has been suggested for the complexes that involves substitution of the $NpO_2^+$ ion for a water molecule in the first coordination sphere of the hexaaquochromium(III) and of the hexaaquorhodium(III) ion. The magnetic splitting in the spectra of the Np(V)-Cr(III) complex and the lack of magnetic splitting for the major fraction of the Np(V)-Rh(III) complex are consistent with the suggested structure. (BLM)

**21963 Equilibrium constants for the metalation of zinc porphyrins.** Hambright, P. (Howard Univ., Washington, DC). *Inorg. Chem.;* **16**: No. 11, 2987-2988(Nov 1977).

The equilibrium for the general equation $m^{2+}$ + $PH_2$ = MP + $2H^+$ for reaction of divalent metal ions and free base porphyrins ($PH_2$) to form metalloporphyrins (MP) was studied using $Zn^{2+}$ and tetra(2-N-methylpyridyl)porphine. Studies were conducted by equilibrating $LiNO_3/HNO_3$, mixtures of $PH_2$, ZnP, $HNO_3$, and $Zn(NO_3)_2$ in the dark at 25.5°C and $\mu$ = 1 for periods of up to 3 weeks. At constant total porphyrin concentrations, isobestic points were found in the visible region indicating that $PH_2$ and ZnP were the major species. The value of the equilibrium constant for the formation of ZnP by the proposed reaction was 188 +- 11 M. Some other data are presented which indicate that the less basic is the porphyrin ligand, the more stable is the corresponding metal-porphyrin complex. (BLM)

**21964 Homopolyatomic anions and configurational questions. Synthesis and structure of the nonagermanide(2-) and nonagermanide(4-) ions, $Ge_9^{2-}$ and $Ge_9^{4-}$.** Belin, C.H.E.; Corbett, J.D.; Cisar, A. (Ames Lab., IA). *J. Am. Chem. Soc.;* **99**: No. 22, 7163-7169(26 Oct 1977).

Reaction of solid KGe with 2,2,2-crypt (4,7,13,16,21,24-hexaoxa-1,10-diazobicyclo[8.8.8]hexacosane) in ethylene-diamine yields deep-red rods which have been shown to be (crypt-$K^+$)$_8Ge_9^{2-}$ $Ge_9^{4-}$ .2.5en by x-ray crystallography. The compound crystallizes in P anti 1 space group with Z = 2 and a = 20.037 (2) A, b = 28.944 (2) A, c = 14.546 (2) A, $\alpha$ = 99.356 (8)°, $\beta$ = 94.077 (8)°, and $\gamma$ = 87.60 (1)°, V = 8312.9 (12) $A^3$ at 25°C. Diffraction data were measured over four octants using a four-circle automated diffractometer and monochromatized Mo K$\alpha$ radiation, and the structure was solved by direct methods and Fourier techniques. The 190 independent (non-hydrogen) atoms in the structure yield, with anisotropic thermal parameters for germanium and potassium, R = 0.149 and R/sub w/ = 0.169 for 8409 independent observed reflections with 2theta equal to or less than 50°. Charges on two $Ge_9$ cluster ions were assigned according to their relationship to isoelectronic $Sn_9^{4-}$ ($C_4v$) and $B_9H_9^{2-}$ (D/sub 3h/). The $Ge_9^{4-}$ ion configuration is quite close to the ideal C/sub 4v,/$^2$ with a nearly square base (3.58 and 3.64 A diagonals and a vicinal dihedral angle delta 5.3°) and delta 162 and 156° for the characteristic opposed faces parallel to the fourfold axis (158° in $Sn_9^{4-}$). The $Ge_9^{2-}$ ion exhibits essentially C/sub 2nu/ symmetry but clearly derives from the D/sub 3h/ limit, with 2.81, 2.86, and 3.17 A for the parallel edges of the trigonal prism, $\delta$ 171° for the opposed faces therein, and capping atoms separated by 4.00, 4.16, and 4.22 A. Atomization energies from SCF-MO-CNDO calculations support the charge assignment deduced geometrically, the differentiation of configurations arising almost entirely from the $Ge_9^{2-}$ ion. The observed distortion of this ion may relate to the generation of a small dipole moment. The configurational contrast between the highly polar $Sn_9^{4-}$ and $Ge_9^{4-}$ (C/4nu/) and the isoelectronic but apolar $Bi_9^{5+}$ (D/sub 3h/) is considered further.

**21965 Deactivation on the $Nd^{3+}$,$^4F$/sub 3/2/ level in neodymium chloride—aluminum chloride vapor complexes.** Jacobs, R.R. (Univ. of California, Livermore); Krupke, W.F.; Hessler, J.P.; Carnall, W.T. *Opt. Commun.;* **21**: No. 3, 395-398(Jun 1977).

The first fluorescence lifetime studies in a trivalent rare earth-metal vapor complex $NdCl_3$ . ($AlCl_3$)/sub x/ are reported. The observed, temperature-dependent, nonradiative deactivation and the inferred radiative lifetime are discussed in terms of various models. At 803 K, corresponding to a density of 4.6 x $10^{17}$ $Nd^{3+}$ ions/$cm^3$ and a total system pressure approximately equal to 5 atm, the measured lifetime is 46$\mu$s.

**21966 Experimental Auger electron spectrum of ammonia.** White, J.M.; Rye, R.R.; Houston, J.E. (Sandia Labs., Albuquerque, NM). *Chem. Phys. Lett.;* **46**: No. 1, 146-150(15 Feb 1977).

The first electron excited Auger electron spectrum for gas-phase ammonia has been obtained and is compared with an existing

theoretical prediction. Decomposition of the spectrum using a Gaussian approximation reveals close agreement in both intensity and energy for the higher energy components provided the theoretical data is shifted toward lower energies by approximately 2.7 eV. As the transitions involve progressively deeper final state levels there is a general trend of increasing widths and increasing discrepancy towards lower energy with respect to their predicted positions. Such behavior has been seen in other experimental-theoretical comparisons for gas-phase Auger results and while the variation in widths is interpreted in terms of transitions to a manifold of final state vibrational levels, the nature of the differential shift in the lower energy components is unclear.

**21967 Synthesis and crystal structure of a magnesium—lithium—scandium protopyroxene.** Smyth, J.R. (Los Alamos Scientific Lab., NM); Ito, J. *Am. Mineral.;* **62**: No. 11/12, 1252-1257(1977).

Crystals of protopyroxene solid solution, Li/sub x/Sc/sub x/Mg/sub 2-x/$Si_2O_6$, 0.1 equal to or less than x equal to or less than 0.35, were grown, in solvents of the system $Li_2O$-$V_2O_5$-$MoO_3$, by cooling from 1350 to 650° at 1.5°C per hour. The crystals are transparent, euhedral, and prismatic, elongate parallel to c and up to 15 x 4 x 3 mm in size, with well-developed [010], [110], and [121] faces. The cell edges used for structure analysis are: a = 9.251, b = 8.773, and c = 5.377A. Long-exposure x-ray precession photographs showed no diffraction maxima inconsistent with space group Pbcn and no evidence of stack disorder. The crystal structure was refined from 1507 measured x-ray intensities, of which 826 were greater than 3sigma of the background intensity. Refinements of the structure in space groups $P2_1cn$, Pb2n, $Pbc2_1$, and P2/c yielded structures which did not differ significantly from that in space group Pbcn. The structure is ordered with all of the $Sc^{3+}$ in M1 and all of the $Li^+$ in M2.

**21968 Tripotassium hydroxylaminetrisulfonate sesquihydrate, neutron data.** Brown, G.M.; Strydom, O.A.W. (Oak Ridge National Lab., TN). *Acta Crystallogr., Sect. B;* **33**: 1591-1594(1977).

$K_3[SO_3ON(SO_3)_2]$ . $^3/_2H_2O$, monoclinic, I2/c (distinguished from Ic by intensity statistics), a = 25.5873 (40), b = 6.7771 (4), c = 13.9694 (12) A, $\beta$ = 92.08 (1)° [$\lambda$(Mo K$\alpha$) = 0.71069 A, 23.5 +-1.0°C], Z = 8, p/sub c/ = 2.275 g $cm^{-3}$. Angle data: S-N-S, 118.9 (1); S-N-O, 105.4 (1) and 106.3 (1); N-O-S, 113.8 (1); H-O-H, 106.9 (3) and 107.2 (6)°. Bond lengths: N-S, 1.745 (2) and 1.755 (2); N-O, 1.434 (1); S-O (O on N), 1.664 (2); S-O ($SO_3$ groups), 1.432 (2) to 1.444 (2), mean 1.437 (r.m.s.d. = 0.004) A. There is only one hydrogen bond of significant strength, with distances O...O and H...O of 2.935 (2) and 2.022 (3) A and angle O-H...O = 161.6 (3)°.

**21969 Paramagnetic spin relaxation in $Cs_2NaYbCl_6$.** Dunlap, B.D. (Argonne National Lab., IL); Shenoy, G.K.; Dattagupta, S.; Asch, L. *Physica, B, C;* **86-88**: 1267-1268(1977).

Theoretical line shapes are obtained for Mossbauer spectra in the presence of paramagnetic relaxation effects which do not involve the "white noise" approximation. The results are applied to the data for $^{170}Yb$ in $Cs_2NaYbCl_6$ to give values for the rms dipolar field and the spin correlation time in this material.

**21970 Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate.** Maffly, R.L.; Johnson, P.L.; Koch, T.R.; Williams, J.M. (Argonne National Lab., IL). *Acta Crystallogr., Sect. B;* **33**: 558-560(1977).

$Na_2[Pt(CN)_4Br_2].2H_2O$, orthorhombic, Pnma ($D^{16}$/sub 2h/), a = 11.949 (11), b = 15.124 (14), c = 6.487 (6) A, Z = 4, D/sub m/ = 3.06, D/sub x/ = 3.065 g $cm^{-3}$. A room-temperature, single-crystal neutron diffraction study was performed. The structure was solved by direct methods and refined by full-matrix least-squares techniques to $R(F_o^2)$ = 0.068 for 1447 observed reflections > 1sigma($F_o^2$). The structure consists of octahedrally coordinated platinum(IV) complex anions interacting with both the sodium cations and the waters of hydration.

**21971 Pressure-broadened linewidths of hydrogen sulfide.** Tejwani, G.D.T.; Yeung, E.S. (Ames Lab., IA). *J. Quant. Spectrosc. Radiat. Transfer;* **17**: 323-326(1977).

Self-broadened and foreign-gas ($N_2$ and $O_2$) broadened linewidths of $H_2S$ at 300°K have been calculated using the Anderson-Tsao-Curnutte theory of line broadening for a wide range of quantum numbers J and K/sub alpha/, in both type A and type B bands. Computed values for self-broadened linewidths are in good agreement with the experimental results of Helminger and De Lucia. Air broadened linewidths of $H_2S$ at 200°K have also been calculated, so that the temperature dependence can be estimated.

**21972 Estimating unit cell volumes from powder diffraction data: the triclinic case.** Smith, G.S. (Univ. of California, Livermore). *J. Appl. Crystallogr.;* **9**: 424-428(1976).

In the computer indexing of powder diffraction patterns, an advance estimate of the volume of the unit cell is extremely valuable. This paper describes a method for estimating it directly from powder-pattern data for the case of triclinic materials. The method involves an easily prepared graphical plot, the slope of which is proportional to the unit-cell volume. First, the diffraction lines are numbered consecutively, starting with the largest d value (N = 1). A plot is then made of 1/N versus $d^2$. Theoretically, the resulting line has a slope of $3/(2\pi V)=0.4775/V$ for triclinic compounds, where V is the unit-cell volume. Examination of the graphs plotted for a number of triclinic materials where the experimental data are of high quality shows that the slope consistently falls around 0.60/V. Hence, the volume of the unit cell and/or the calculated density can be estimated. In addition, this analysis gives a numerical measure of the fraction of possible diffraction lines actually observed.

**21973 (IS-Trans—97) Production and properties of antimony(V) aquoxide for the separation of natrium in activation analysis.** Toeroek, G.; Diehl, J.R. Translated by M.S. Johnson from *Radiochim. Acta;* **15**: 96(1971). 12p. Dep. NTIS, PC A02/MF A01.

Hydrated antimony pentoxide (HAP) was used to remove sodium from biological samples prior to neutron activation analysis. Five different methods for the preparation of HAP were investigated. Superior results were obtained with the following procedure: hydrolysis with 10 percent $NH_4OH$, 12-hr maturation, and 5 hours of drying at 270°C. The procedure yielded a lemon yellow substance with good mechanical properties. Sorption experiments were performed with columns. Maximal load was 11 mg/g HAP.

### ISOTOPE EFFECTS

*REFER ALSO TO CITATION(S) 21152*

### ISOTOPE EXCHANGE AND ISOTOPE SEPARATION

*REFER ALSO TO CITATION(S) 21142, 21457*

**21974 Isotopically selective ir photodissociation of $SeF_6$.** Tiee, J.J.; Wittig, C. (Electrical Engineering Department, University of Southern California, University Park, Los Angeles, California 90007). *Appl. Phys. Lett.;* **32**: No. 4, 236-238(15 Feb 1978).

The isotopically selective ir photodissociation of $SeF_6$ is reported. The output from an $NH_3$ laser (780.5 $cm^{-1}$, 50 mJ, 200 nsec FWHM) is used to photodissociate $SeF_6$, and the five abundant isotopes of Se are all enriched despite the rather small (~1.6 $cm^{-1}$/amu) isotope shift of the $\nu_3$ vibration. These results are predictable using a simple empirical technique which can be applied equally well to the ir photodissociation of other molecules.

## ORGANIC CHEMISTRY

### CHEMICAL AND PHYSICOCHEMICAL PROPERTIES

*REFER ALSO TO CITATION(S) 20885, 20896, 21256, 21911, 21948, 21953*

**21975 (COO—2837-3) Stereoelectronic properties of aggregate chlorophyll systems. Progress report, January 1—December 31, 1977.** Christoffersen, R.E.; Maggiora, G.M. (Kansas Univ., Lawrence (USA)). Sep 1977. Contract EY-76-S-02-2837. 19p. Dep. NTIS, PC A02/MF A01.

During the first eight months of the second contract period substantial progress was made on a number of the projects proposed. Ab initio configuration interaction calculations on magnesium prophine, porphine, magnesium chlorin, and chlorin were completed, and the electronic structure and properties (e.g. transition energies and oscillator strengths) of their low-lying singlet and triplet states analyzed. Preliminary results from similar calculations on ethyl pheophorbide a and ethyl chlorophyllide a were also obtained, and a detailed analysis of these results is in progress. In order to investigate the geometric aspects of monomeric and aggregated chlorophyll systems, extensive characterization and development of empirical potential functions was undertaken. A set of potential functions suitable for the study of chlorophyll-type systems has been obtained, and initial studies on the geometry of ethyl chlorophyllide a were completed with excellent results. Currently, conformational analysis of chlorophyllide macrocycle substituents is being carried out to assess the presence of energetically important conformational states. Methodology assessment, development, and implementation was also continued. Of particular importance in this regard is the implementation of an $N^5$ algorithm for transforming atomic into molecular two-electron integrals. Work has continued on basis set development, and double-zeta quality basis sets are now available for carbon, nitrogen, and oxygen. Development of comparable single-zeta basis sets and inclusion of polarization functions in the double-zeta basis sets are currently being investigated.

**21976 (LBL—6682) Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy.** Lindner, D.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.).

Nov 1977. Contract W-7405-ENG-48. 144p. Dep. NTIS, PC A07/MF A01.

Thesis.

We have examined the binding of several transition metal ions by the iron storage protein, ferritin, as well as its iron-free derivative, apoferritin. The ions studied include ferric ion, manganous ion, crupous and cupric ions, and vanadyl ion. Ferric ion is found to bind to both ferritin and apoferritin in a site of rhombic crystal field symmetry. Iron is bound only loosely to this site. Cupric ion is found to bind in two different ways. One way involves a copper "tight-binding" site which strongly and specifically binds the element. The binding is highly pH dependent with as many as two ions per protein subunit binding to both ferritin and apoferritin. Copper bound in this site is shown to dramatically alter the kinetics of iron release from ferritin by reducing agents. Cupric ion in excess of that bound in the "tight-binding" site is observed to bind in a "solution-like" manner to the apoferritin (but not to the ferritin). Such cupric ion is free to tumble isotropically. In a similar manner, manganous ion associated with apoferritin gives rise to solution-like spectra, which exhibit a line broadening of 12% relative to manganous ion under the same conditions in the absence of apoferritin. Apoferritin can concentrate metal ions in its central cavity by acting as an ion exchanger. Vanadyl ion is also observed to associate with apoferritin in such a way as to retain a great deal of rotational freedom of motion. This ion appears to be present in the apoferritin inner cavity. We observe a pH dependent spectrum resulting from the deprotonation of a water molecule coordinated to the ion. Spectral properties of this ion in association with apoferritin are discussed in light of the unusual properties of water in small cavities lined with charged groups.

**21977** (MHSMP—77-60) **Hydrogen gas from cured RTV silicones.** Myers, L.C. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Oct 1977. Contract EY-76-C-04-0789. 10p. Dep. NTIS, PC A02/MF A01.

Eight different RTV silicones were sealed in containers, and after preselected times the amount of hydrogen in the containers was determined. The silicone samples were conditioned at 80°C in a 100% RH air atmosphere and at 23°C in a dry air atmosphere. The amount of gas from duplicate samples varied considerably. The cause of these variations was investigated, and it was determined that humidity in a helium atmosphere produced the maximum hydrogen, and the amount of hydrogen is less if oxygen is present in the atmosphere. 10 figures, 3 tables.

**21978** (ORO—3018-180) **Physico-chemical study of some areas of fundamental significance to biophysics. Final report, 1974—1977.** McGlynn, S.P. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry). 18 Aug 1977. Contract EY-76-S-05-3018. 205p. Dep. NTIS, PC A10/MF A01.

The comprehensive report includes a complete list of publications resulting from the work and a review of studies made in the vacuum ultraviolet, photoelectron spectroscopy, excited states and electron structure of inorganic salts, a model for polar molecules, application of abstract mathematics to the genetic code, the orbital approximation in which orbital properties are related to state properties. (JSR)

**21979 Calculation of $^{13}C$ relaxation times and nuclear Overhauser enhancements in a hydrocarbon chain undergoing gauche-trans isomerism.** London, R.E.; Avitabile, J. (Los Alamos Scientific Lab., NM). *J. Am. Chem. Soc.;* **99**: No. 24, 7765-7776(23 Nov 1977).

An analytically tractable model has been developed for calculating the relaxation times of a hydrocarbon chain undergoing gauche-trans isomerization about each carbon-carbon bond and overall isotropic motion. Each internal rotation is described by two parameters, tau/sub t/, the lifetime of a trans state, and sigma, the equilibrium ratio of gauche to trans states: sigma = $([g^+] + [g^-])/2[t]$. Spin lattice relaxation times ($T_1$), spin-spin relaxation times ($T_2$), and nuclear Overhauser enhancements (NOE) have been calculated for a six-bond chain. As a result of the restriction introduced into the internal motion, properties associated with the slowly tumbling end of the molecule such as a reduced NOE, $T_1$ much greater than $T_2$, and a frequency dependence of $T_1$ propagate far into the chain in contrast to the free internal rotation mode. Analysis of data obtained for n-hexadecyltrimethylammonium bromide micelles and for sonicated dimyristoyl lecithin lipid vesicles indicates that restriction of internal rotation is not sufficient to explain the observed $T_1$ and $T_2$ values. For this reason, the effects of correlated motions such as kink formation and diffusion have been treated semiquantitatively and a correlation factor f introduced to reflect the degree of motional correlation. The three possible contributions to the observed $T_1$ gradient (cumulative effects of successive internal gauche reversible trans isomerizations as modified by an appropriate correlation factor, a gradient in the isomerization rate as described by tau/sub t/, and a gradient in sigma) are evaluated in light of available experimental data. In general, $T_1$ values measured in systems undergoing multiple isomerizations are found to be sensitive to the order of the system as well as to the rate of internal motion. For typical parameters, $T_2$ values are found to be sensitive to the degree of motional correlation and to the value of sigma, but not to the isomerization rate.

**21980 Kempene-1 and -2, unusual tetracyclic diterpenes from Nasutitermes termite soldiers.** Prestwich, G.D. (International Centre of Insect Physiology and Ecology, Nairobi, Kenya); Solheim, B.A.; Clardy, J.; Pilkiewicz, F.G.; Miura, I.; Tanis, S.P.; Nakanishi, K. *J. Am. Chem. Soc.;* **99**: No. 24, 8082-8083(23 Nov 1977).

The structures of two new diterpenes, isolated from the hexene extract of crushed heads of Nasutitermes kempae soldiers by chromatography, are reported. They have novel tetracyclic cembrene-derived carbon skeletons. (JSR)

**21981 Structure and energetics of simple carbenes $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$.** Bauschlicher, C.W. Jr.; Schaefer, H.F. III; Bagus, P.S. (Univ. of California, Berkeley). *J. Am. Chem. Soc.;* **99**: No. 22, 7106-7110(26 Oct 1977).

There is very little experimental data concerning the singlet—triplet separations of carbenes. In many cases, it is not even possible to form estimates of this separation from experimental results. $CH_2$ is a distinct exception; here substantial, although contradictory, data are available. The equilibrium geometries of the lowest singlet states of several carbenes have been determined experimentally. However, the geometries of many states are not known and the triplet state geometries are also generally unknown. In order to obtain theoretical information about these quantities for a series of halogenated carbenes, we have studied $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$ using a consistent level of ab initio electronic structure theory. One configuration (triplet state) and two configuration (singlet state) wave functions have been computed. Double zeta basis sets augmented by a d function on the carbon atom, optimized separately for both the singlet and triplet states of each molecule, were used. The theoretical equilibrium geometries agree well with the available experimental data. The trends of the singlet-triplet separations are discussed and correlated with the carbon atom Mulliken gross populations for the singlet and triplet states.

**21982 Mannich Bases containing tertiary amines and fuel compositions containing said Mannich Bases.** Garth, B.H. (to E. I. Du Pont de Nemours and Co.). US Patent 4,054,422. 18 Oct 1977. Filed date 12 Sep 1975. 10p.

A novel class of Mannich Bases is described, which provide carburetor detergency. Mannich Bases are condensation products of an alkylphenol, an aldehyde, and an amine. The present compositions at low concentrations have a minimal effect on the intake valve deposit weight increase and at high concentrations provide control or even reduction of the deposit weights.

**21983 Effect of pressure on the fluorescence and absorption of adamantanone.** Hara, K.; Schuster, G.B.; Drickamer, H.G. (Univ. of Illinois, Urbana). *Chem. Phys. Lett.;* **47**: No. 3, 462-465(1 May 1977).

The effect of external high pressure on the absorption and fluorescence spectra of solid 2-adamantanone was investigated. Three different pressure dependent responses were observed. These spectral changes are rationalized in terms of the known solvent effects on n/pi* transitions.

**21984 Trichloroethylene. I. An overview.** Waters, E.M.; Gerstner, H.B.; Huff, J.E. (Oak Ridge National Lab., TN). *J. Toxicol. Environ. Health;* **2**: 671-707(1977).

Trichloroethylene (TCE) has been an industrial chemical of some importance for the past 50 years. First synthesized by Fischer in 1864, TCE has enjoyed considerable industrial usage as a degreaser and limited medical use as an inhalation anesthetic and analgesic. This TCE overview provides a narrative survey of the reference literature. Highlights include history, nomenclature, physical and chemical properties, manufacture, analysis, uses, metabolism, toxicology, carcinogenic potential, exposure routes, recommended standards, and conclusions. Chemically, TCE is a colorless, highly volatile liquid of molecular formula $C_2HCl_3$. Autoxidation of the unstable compound yields acidic products. Stabilizers are added to retard decomposition. TCE's multitude of industrial uses center around its highly effective fat-solvent properties. Metabolically, TCE is transformed in the liver to trichloroacetic acid, trichloroethanol, and trichloroethanol glucuronide; these breakdown products are excreted through the kidneys. Most toxic responses occur as a result of industrial exposures. TCE affects principally the central nervous system (CNS). Short exposures result in subjective symptoms such as headache, nausea, and incoordination. Longer exposures may result in CNS depression, hepatorenal failure, and increased cardiac output. Cases of sudden death following TCE exposure are generally attribued to ventricular fibrillation. Current interest in TCE has focused on recent experimental data that implicate TCE as a cause of hepatocellular carcinoma in mice. No epidemiological data are available that demonstrate a similar action in humans. The overall population may be exposed to TCE through household cleaning fluids, decaffeinated coffee, and some spice extracts. The NIOSH recommended standard for TCE is 100 ppM as a

time-weighted average for an 8-hr day, with a maximum allowable peak concentration of 150 ppM for 10 min.

### ISOTOPE EFFECTS

**21985** (N—77-26240) **The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules.** Galimov, E.M. (Kanner (Leo) Associates, Redwood City, CA). Translated from *Zh. Fiz. Khim.;* **48**: No. 6, 1381-1385(1974). 11p. (NASA-TT-F—17450). NTIS PC A02/MF A01.

The decomposition of humified organic matter is accompanied by a depression of the kinetic effect. The hypothesis that this phenomenon is caused by a wide band of activation energies is investigated. Examination of a multilayer decomposition model corresponding to this case reveals that the isotope fractionation is significantly smaller than the isotope fractionation in the case of a monolayer model corresponding to the dissociation of simple organic compounds. The degree of depression depends on the width of the activation energy band.

## ELECTROCHEMISTRY

*REFER ALSO TO CITATION(S) 21770*

**21986** (Y—2107) **Investigation of a lithium electrolytic cell failure.** Anderson, R.C. (Oak Ridge Y-12 Plant, Tenn. (USA)). Dec 1977. Contract W-7405-ENG-26. 12p. Dep. NTIS, PC A02/MF A01.

Electrolytic cells, used to produce lithium metal, fail after approximately three years in service. A metallurgical investigation revealed that molten lithium at 440°C was dissolving the carbon in the cementite which is a constituent in the steel plate from which the cell is fabricated.

**21987** **Electrolyte theory: improvements since Debye and Hueckel.** Pitzer, K.S. (Univ. of California, Berkeley). *Acc. Chem. Res.;* **10**: No. 10, 371-377(Oct 1977).

First we recall that there is not yet an adequate theory for water (or for other ionizing solvents); hence any theory must start with assumptions concerning the interionic potentials of mean force in the solvent. From that point, however, we now have an exact theory which can be applied numerically to obtain as accurately as desired the interionic radial distribution functions and thermodynamic properties. There is no longer any need to speculate about the net inaccuracies in the Debye—Hueckel theory, or extensions thereof, or of other approximate theories. These questions can be answered by comparison with calculations based on exact theories. The original Debye—Hueckel (D—H) expression which contained no contribution from the direct effects of short-range forces is seriously inadequate outside of the range of the limiting law. But the D—H calculation of interionic distribution functions is found to be surprisingly accurate in either the exponential or three-term expansion form (at least for the model for aqueous 1—1 electrolytes with ionic diameters near 4 A). The three-term expansion form of these distributions can be used in the "pressure" equation to yield a simple but relatively accurate expression for the osmotic coefficient up to about 1 M for this model. It is now feasible also to investigate more realistic interionic potentials. This should be very valuable in the future, although the requirement of fitting osmotic and activity coefficient data is not likely to yield a unique determination of the short-range potential. The recent theory suggested important improvements in the form of semiempirical equations. Reasonably simple equations are now available which fit within experimental accuracy a wide variety of data on pure and mixed electrolytes. Also, since the more important parameters are determined from the single solutes, the equations allow prediction of the properties of mixtures.

## PHOTOCHEMISTRY

*REFER ALSO TO CITATION(S) 21975*

**21988** (PB—269858) **Effect of selected parameters on predictions of a photochemical model.** Dodge, M.C. (Environmental Protection Agency, Research Triangle Park, N.C. (USA). Environmental Sciences Research Lab.). Jun 1977. 53p. (EPA—600/3-77/048). NTIS PC A04/MF A01.

A sensitivity study was undertaken to assess the effect of selected parameters on the predictions of a photochemical kinetics model. The model was previously developed for use in designing control requirements for ozone reduction in urban areas. The parameters varied in the present study included (1) solar energy, (2) dilution rate, (3) post 9-A.M. emissions, and (4) hydrocarbon composition of 6-9 A.M. emissions. Based on the results of the simulations for each of these parameters, $O_3$ isopleths as a function of initial nonmethane hydrocarbon and NOx were constructed. A comparison of the degree of hydrocarbon control predicted to achieve the air quality standard for $O_3$ was made for each set of isopleths. It was found that the predictions of the model are largely insensitive to the parameters investigated when the results of the simulations are interpreted in a relative sense.

**21989** **Unimolecular decomposition of cyclo-$C_4F_8$ induced by a $CO_2$ TEA laser.** Preses, J.M. (Brookhaven National Lab., Upton, NY); Weston, R.E. Jr.; Flynn, G.W. *Chem. Phys. Lett.;* **46**: No. 1, 69-74(15 Feb 1977).

Octafluorocyclobutane has been shown to decompose clearly to tetrafluoroethylene when irradiated at room temperature with 949 $cm^{-1}$ radiation from a pulsed $CO_2$ laser. A calculation of the energy absorbed from the laser beam, combined with known unimolecular rate constants for the corresponding thermal reaction, indicates that the thermal reaction cannot account for the observed product yields. It is proposed that reaction of vibrationally excited molecules is responsible for the observed reaction.

**21990** **Electron spin resonance study of liquids during photolysis. XXII. The 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions.** Zeldes, H.; Livingston, R. (Oak Ridge National Lab., TN). *J. Magn. Resonance;* **25**: 67-81(1977).

An electron spin resonance study of the 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions is reported. The radical undergoes a reversible, base-catalyzed dissociation of the NH-hydrogen. At high NaOH concentrations the rate of interconversion of the dissociated and undissociated radical is rapid, resulting in a single sharp-lined spectrum whose parameters depend upon the degree of dissociation. The equilibrium constant of the base-catalyzed reaction was determined, and from it the equilibrium constant for the ionization in aqueous solution was calculated. The latter for an aqueous solution containing 20 ml of isopropyl alcohol per liter of solution at 32°C, expressed in pK units, is 16.64 +- 0.1. At lower concentrations of NaOH the dynamic equilibrium serves to reorient the NH-hydrogen spin state of the undissociated radical, and thus produces lineshape effects which depend upon the rate of dissociation. The second-order rate constants at infinite ionic dilution for the forward and backward directions, respectively, of the base-catalyzed dissociation reaction for an aqueous solution containing 100 ml of isopropyl alcohol per liter of solution at 32°C are (2.2 +- 0.6) x $10^7$ and approximately 3 x $10^8$ $M^{-1}$ $sec^{-1}$. The g values and couplings of both radicals were determined, and couplings are compared with values estimated from MO calculations.

**21991** **Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$.** Kronebusch, P.L.; Berkowitz, J. (Argonne National Lab., IL). *Int. J. Mass Spectrom. Ion Phys.;* **22**: 283-306(1976).

Branching ratios have been measured for the photodissociative ionization of $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$ and $CH_4$ between 16.8 and 40.8 eV, using line sources. Inconsistencies in previous photoionization fragmentation patterns for NO and $H_2O$ at 21.2 eV, and for $CH_4$ at 16.8 eV, have been clarified. The high energy state of $CO^+$ has been found to decay predominantly to $O^+ + C$, in contrast to a recent study. Partial cross sections for formation of high energy states in $O_2^+$ and $CO_2^+$ deduced from this study are substantially lower than those reported in a recent 304 A photoelectron spectroscopic investigation. The $NO^+$ decomposition at higher energy favors $N^+ + O$, although the lower energy channel is $O^+ + N$. Ionization from the inner (2s-like) valence states of $CO_2$ and $H_2O$ leads to $C^+$ and $O^+$ fragments, respectively, with probable shattering of the molecular ion into atomic and ionic fragments.

## RADIATION CHEMISTRY

*REFER ALSO TO CITATION(S) 21173*

**21992** (COO—913-68) **Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976—August 31, 1977.** Lipsky, S. (Minnesota Univ., Minneapolis (USA)). 1977. Contract EY-76-S-02-0913. 21p. Dep. NTIS, PC A02/MF A01.

The fluorescence of N,N,N',N'-tetramethyl-p-phenylenediamine (TMPD) has been studied in the solvents n-hexane, methylcyclohexane, cyclohexane, isooctane, and tetramethylsilane for excitation energies below and above the photoionization threshold. Evidence is obtained for the existence, as a major intermediate in the photoionization process of a coherent but spatially diffuse excited state of TMPD. Electron impact spectra of $NH_3$ at low energies and 90° scattering angle has failed to reveal any evidence for a low-lying valence triplet. For simple saturated hydrocarbons, large angle electron-impact spectra also fail to reveal any evidence for low-lying valence triplet states. Therefore if valence-shell transitions exist at all in these molecules they must be imbedded at significantly higher

energies in the absorption manifold. The fluorescence of the A → X transition in ammonia-$d_3$ has been studied in the presence of saturated hydrocarbon perturbers up to densities of approximately 6 M. Essentially no change in fluorescence quantum yield is observed. This eliminates inelastic processes as contributing importantly to pressure broadening and to shifting of the A reverse arrow X transition. The pressure broadening and pressure shifting of the first 10 vibrational peaks in the A reverse arrow X (n/sub N/ → 3s Rydberg) absorption of $NH_3$ has been studied using He, Ne, Ar, $N_2$, $CH_4$, $CF_4$ and $SF_6$ gases up to pressures of approximately 100 atm. Both blue and red shifts are observed depending on the nature of the perturber. A dependence of the magnitude of the shift on vibrational level is observed and attributed to important variations of the electronic wavefunction of the upper state with position of the nuclei.

**21993 Electron spin echo modulation studies of silver atom solvation and desolvation in ice matrices.** Narayana, P.A.; Becker, D.; Kevan, L. (Department of Chemistry, Wayne State University, Detroit, Michigan 48202). *J. Chem. Phys.;* **68**: No. 2, 652-654(15 Jan 1978).

Electron spin echo modulation patterns have been obtained at 4.2 K and analyzed for desolvated silver atoms produced at 4.2 K by radiolysis of deuterated ice matrices containing AgF and for solvated silver atoms produced by brief warming to 77 K. The analysis shows that desolvated $Ag^0$ is surrounded by eight equivalent deuterons at 3.1 +- 0.1 A which suggests a tetrahedral model of four waters with their dipoles pointed away from $Ag^0$ (i.e., a solvated $Ag^+$ geometry). Solvated $Ag^0$ appears to be formed by rotation of one or two waters around one of their OD bonds to put one or two deuterons at ~ 1.8 A from $Ag^0$. These close deuterons do not contribute to the echo modulation pattern because the nuclear splitting is larger than the microwave magnetic field, and the remaining six or seven deuterons at 3.1 A produce the modulation pattern.

**21994 Uranium recovery trials at Risoe.** Rasmussen, I. (Research Establishment Risoe, Roskilde (Denmark)). *Data Rep.;* **100**: No. 11, p. 12-14(1976). (In Danish).

Trial drilling of the ore deposits at Kvanefjeld in South Greenland have shown an amount of 5600 tons of uranium, to which it is estimated a further 8000 tons can be added. As the uranium content is low, ca. 300g/ton, and the mineral composition is unusual, the usual recovery techniques cannot be used and a special process is required. Uranium recovery on a small technical scale (130 tons of ore) was started at the Risoe National Laboratory, Denmark in September 1976. The method used is based upon sulfatizing roasting. The plant can handle 2.5 tons of ore daily. An industrial plant shoud have a capacity of 6-10 tons of ore per minute. To obtain a sufficiently comprehensive basis on which to evaluate the economy of the recovery process, and to determine the technical specifications needed for an industrial plant, it would be necessary to build a further pilot plant dimensioned for 25-50 tons ore per day.

## RADIOCHEMISTRY AND NUCLEAR CHEMISTRY

### PROPERTIES OF RADIOACTIVE MATERIALS

*REFER ALSO TO CITATION(S) 21212, 21213, 21962, 22310*

**21995 Structure of uranyl nitrate-bis(tetrahydrofuan).** Reynolds, J.G.; Zalkin, A.; Templeton, D.H. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 12, 3357-3359(Dec 1977).

The tetrahydrofuran complex of uranyl nitrate $UO_2(NO_3)_2$ $2C_4H_8O$ was prepared and its crystal structure was determined. Cell parameters of a = 9.412 (7) A, b = 12.649 (9) A, C = 7.237 (5) A, $\beta$ = 117.12 (6), and V = 766.8A were determined. The molecular structure was found to consist of a U atom on a center of symmetry coordinated to eight O atoms. The two uranyl O atoms were found to be perpendicular to the plane of the remaining coordinating O atoms. (BLM)

**21996 Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides.** Reynolds, J.G.; Edelstein, N.M. (Univ. of California, Berkeley). *Inorg. Chem.;* **16**: No. 11, 2822-2825(Nov 1977).

The thorium and uranium alkylamides $M[N(CH_2CH_2CH_3)_2]_4$ and $M[N(CH_2CH_2CH_2CH_3)_2]_4$ (M = Th and U) have been prepared and isolated. These extremely air-sensitive compounds are liquids at room temperature and distillable under high vacuum at temperatures less than 100°C. The proton magnetic resonance spectra, the optical spectra, and the temperature-dependent magnetic susceptibilities (T = 4.2 to 100 K) of the two uranium compounds are reported. The spectroscopic and magnetic properties of the uranium compounds are very similar to those of $U(N(C_2H_5)_2)_4$.

**21997 Cyclotron production of $^{13}N$ compounds for environmental and biological research.** Parks, N.J.; Krohn, K.A. (Univ. of California, Davis). *Trans. Am. Nucl. Soc.;* **27**: 215-216(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**21998 Molecular beam study of the kinetics of the fluorine—uranium dioxide reaction.** Machiels, A.J. Berkeley, CA; Univ. of California (1976). 127p. University Microfilms Order No. 77-15,776.

Thesis (Ph. D.).

The kinetics of uranium dioxide fluorination were studied using an experimental system in which a molecular beam of fluorine was directed at a heated uranium dioxide single crystal wafer maintained in high vacuum. Gaseous reaction products desorbed from the uranium dioxide were monitored by a quadrupole mass spectrometer with an off-axis electron multiplier. The fluorine beam was modulated; ac phase-lock detection and pulse counting were employed to enhance the signal-to-noise ratio. By the modulated molecular beam mass spectrometry technique, both the apparent reaction probability and the reaction phase lag were obtained. Reaction probabilities of 1 x $10^{-4}$ or greater could be detected. The uranium dioxide targets were heated from the rear by electron bombardment to a maximum of 1800°K. The equivalent fluorine beam pressure at the target ranged between 1 x $10^{-7}$ and 1 x $10^{-4}$ torr. The beam modulation frequency could be varied from 1 to 900 Hz. Flourination of the uranium dioxide was found to produce uranium tetrafluoride in the 900 to 1600°K range, confirming the results obtained from thermodynamic considerations (quasi-equilibrium analysis). The kinetics of the interactions were found to be strongly non-linear. With regard to fluorine an apparent order of reaction greater than one was found under low fluorine beam pressure and/or high temperature conditions. An apparent order of one was eventually obtained as the target temperature was decreased and/or the beam intensity was increased. Phase lags were found to be generally dependent upon the fluorine beam pressure. Fluorination of the uranium dioxide was found to be affected by some process acting as a flywheel smoothing the phase response of the interaction as the modulation frequency was varied. Well established reaction and diffusion mechanisms identified in previous modulated beam investigations failed to fit the data and further work is warranted in this area.

### RADIOISOTOPE PRODUCTION

*REFER ALSO TO CITATION(S) 21171*

## COMBUSTION CHEMISTRY

**21999 (LBL—6850) Nature and formation of nitrogenous air pollutant emissions from combustion systems.** Matthews, R.D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1977. Contract W-7405-ENG-48. 239p. Dep. NTIS, PC A11/MF A01.

Thesis.

Many nitrogen-containing species may be emitted from combustion systems. These sources are reviewed. The atmospheric chemistry and toxicology of the nitrogenous air pollutants which have been identified in the emissions from combustion systems is reviewed. Combustion generated N-species may be derived either from thermal fixation of $N_2$ or from the use of fuels containing high concentrations of bound nitrogen. Many strategies which decrease emissions of thermal NO adversely affect emissions of fuel-derived NO. The emissions of fuel-derived N-species, especially NO, from catalytic combustors is investigated. Combustion parameters which are varied include equivalence ratio, adiabatic flame temperature, and fuel nitrogen concentration. For direct comparison with fuel rich catalytic combustion, the same species are monitored in the exhaust of a flat flame burner operating under the same conditions. This comparison allows some estimation of the extent to which heterogeneous reactions are controlling the conversion of fuel nitrogen. Measurements of catalyst temperature, combustion efficiency, and emissions of CO, $CO_2$, and UHC's are also presented. The conversion of fuel nitrogen to NO is found to be strongly dependent on equivalence ratio, moderately dependent on fuel nitrogen concentration, and weakly dependent on the calculated adiabatic flame temperature. The NO yield is much lower for catalytic combustion than for gas phase combustion for all equivalence ratios except near stiochiometric. Contrasts in the behavior exhibited by homogeneous and catalytic combustion indicate that the fuel nitrogen conversion mechanism may be dominated by surface reactions during catalytic combustion. The evidence gathered in this investigation indicates that staged catalytic combustion may be preferable to homogeneous staged combustion or stoichiometric catalytic combustion.

**22000 (LBL—7228) Computational aspects of Glimm's method.** Chorin, A.J. (California Univ., Berkeley (USA). Lawrence Berkeley

Lab.). Oct 1977. Contract W-7405-ENG-48. 13p. Dep. NTIS, PC A02/MF A01.

The application of Glimm's method to the equations of gas dynamics is considered. In particular, its advantages are discussed for situations in which chemical reactions occur in the gas. 1 figure.

# ENGINEERING

## FACILITIES AND EQUIPMENT

**22001** (SAND—77-0646) **Locating a buried earth penetrator.** Caffey, T.W.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0789. 34p. Dep. NTIS, PC A03/MF A01.

The purpose of this work was to assist the recovery of a buried earth penetrator by locating the vertical projection of the penetator upon the surface within a horizontal radius error of one meter. The penetrator will carry a small coil which is driven by an alternating current to form a magnetic dipole. Five measurements of the magnetic field vector upon the surface of the earth are shown to be sufficient for determining not only the xyz-coordinates of the dipole, but also the orientation of the dipole axis. The theory, computation process, and field tests are comprehensively described. Results of 26 field tests with the dipole at 9 different combinations of location and orientation are given. Average radial and vertical location errors are 0.27 m and -0.05 m, respectively, while the mean errors in the tilt and orientation angles of the dipole axis are 3 degrees and 8 degrees, respectively. The results are applied to the design of a locating system for a Pershing II penetrator which contains a recessed, rear-mounted coil.

**22002** (SAND—77-1436C) **Valued renewal processes.** Engi, D.; Solberg, J.J. (Sandia Labs., Albuquerque, N.Mex. (USA); Purdue Univ., Lafayette, Ind. (USA). School of Industrial Engineering). 9 Sep 1977. Contract EY-76-C-04-0789. 15p. (CONF-780204—1). Dep. NTIS, PC A02/MF A01.

From Proceedings of the 8th annual meeting; Jacksonville, FL, USA (15 Feb 1978).

The total value of a class of stochastically determined revenues earned periodically over time, as well as periodically incurred costs, can be approximated in simple terms via a classical result from renewal theory. In addition, recent results permit an improved approximation, which can differ significantly from the classical result for finite-time-horizon processes. The standard machine replacement problem is representative of the class of problems that can be studied with this methodology. The theory is outlined and results which can be used in specific cases are given.

**22003** **Effect of material constitutive models on stress wave propagation calculations.** Herrman, W.; Lawrence, R.J. (Sandia Labs., Albuquerque, NM). *J. Eng. Mater. Technol.;* **100**: No. 1, 84-95(Jan 1978).

From Winter annual meeting of the American Society of Mechanical Engineers; Atlanta, GA, USA (27 Nov 1977).

Material models which have been successfully used for describing experimental observations of stress wave propagation in metals, polymers, composites, and porous materials are used in a series of one-dimensional finite-difference calculations of stress pulses propagating in a semi-infinite medium. These calculations show the effect of the material model on pulse attenuation. Parametric variations indicate the sensitivity of the attenuation to the parameters of each model. A simple conceptual description based on the hysteretic energy loss experienced by the material in a loading-unloading cycle is used to explain the results. Relevance of the results to the prediction of damage in specific engineering design calculations is developed. The results and conceptual description should aid the stress analyst in assessing which effects to include in the material model used in specific multidimensional calculations.

**22004** **Optimizing the design and use of an air-driven water pump.** Ramsden, K.W.; Probert, S.D. (Cranfield Inst. of Tech., Bedford, Eng.). *Appl. Energy;* **3**: No. 3, 223-229(Jul 1977).

The design, operation, and performance of an air-jet pump for removing water from foundation trenches, boreholes, etc. are described. High-pressure air forced through the air-jet nozzle creates the low-pressure in the pump and results in suction action to pump the water. The air-jet pump is simple, reliable light weight, cheap, has no moving parts and can handle a variety of fluids. Optimum nozzle design is discussed. Despite the air-jet pump's intrinsically low efficiency, if its design and use are optimized, appreciable energy savings can often be achieved compared with other more conventional, but less readily available means of intermittent water removal for civil engineering applications. (LCL)

**22005** **Effect of the diameter and length of fibers on carcass heat conductivity of metal fiber wicks of heat pipes.** Semena, M.G.; Zaripov, V.K. (Kiev Polytech Inst, Ukr SSR). *Teploenergetika (Moscow);* No. 4, 82-84(Apr 1977). (In Russian).

Results of investigations regarding the effect of the diameter and length of sintered copper fibers on carcass heat conductivity of heat pipe wicks are presented. The diameter of the discrete monodispersed fibers was 20, 40, 70 μm, and the length was 3 and 10 mm. The temperature range was 16-35°C. Formulas are proposed for the calculation of the carcass and effective heat conductivity of metallic fiber wicks of heat pipes.

**22006** **Antistatic resp. conducting polymers filled with carbon black.** Verhelst, W.F. (AKZO Chemie BV, Amsterdam (Netherlands). Zentrale Forschung). *Kunststoffe;* **66**: No. 10, 701-703(1976). (In German).

In contrast to the use of plastics as insulating materials generally, there is a lively demand in many branches of industry for polymers with a certain electrical conductivity (avoiding the build-up of static charges). Insulating and electrically conducting materials differ physically in their specific electrical resistance. In order to reduce this until the required conductivity is obtained, additives which make the plastic conductive have to be mixed with it. The subject of this report is the representation of progress in developing new types of carbon black suitable for this process, and it also treats the technology of mixing and above all the properties and special phenomena of the plastic/carbon black compounds obtained and the final products made from them, according to the latest information.

### CRYOGENIC AND SUPERCONDUCTING EQUIPMENT AND DEVICES

*REFER ALSO TO CITATION(S) 21553, 21759, 22107, 22108, 22591, 22592, 22593, 22594, 22595, 22597*

**22007** **Picosecond pulses on superconducting striplines.** Kautz, R.L. (Cryogenics Division, Institute for Basic Standards, National Bureau of Standards, Boulder, Colorado 80302). *J. Appl. Phys.;* **49**: No. 1, 308-314(Jan 1978).

The attenuation and phase velocity of a superconducting thin-film stripline are calculated at high frequencies using the theory of Mattis and Bardeen. These results are used to study the propagation of picosecond pulses which have frequency components approaching the superconducting energy-gap frequency.

**22008** **Fabrication and properties of high-temperature weak links and SQUID's.** Wu, C.T.; Falco, C.M. (Argonne National Laboratory, Argonne, Illinois 60439). *J. Appl. Phys.;* **49**: No. 1, 361-365(Jan 1978).

We present our latest results on the fabrication and properties of high-T/sub c/ $Nb_3Sn$ thin-film weak links and SQUID's prepared by radiation damage of localized regions. Using radiation damage, we have successfully fabricated high-temperature thin-film weak links with current-voltage characteristics similar to those produced either by proximity effect or ion-implantation techniques. The critical current of these weak links obey a relation I/sub c/proportional (T'/sub c/-T)/sup 3/2/ for T<T'/sub c/, and I/sub c/proportionalexp(-γT) for T>T'/sub c/, where T'/sub c/ is the intrinsic transition temperature of the radiation-damaged region. High-temperature (operation temperature >14.5 K) $Nb_3Sn$ thin-film SQUID's with sensing area ~3 $mm^2$ have been successfully fabricated using these weak links.

**22009** **Monolithic superconducting solenoids.** Derkach, A.Y.; Karnaukhov, I.M.; Kukhanin, A.A.; Sorokin, P.V.; Sporov, E.A.; Glasov, B.V.; Kurnosov, V.I.; Yuferov, V.B. (Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 740-742(Jun 1977).

Six potted solenoids have been fabricated and studied in an effort to improve the critical characteristics of superconducting magnet systems made from multicore twisted cable of type NT-50 alloy. The layers are insulated from each other by fiberglass cloth impregnated with VT-200 epoxy (SKTF-1 compound). The total thickness of the cement-impregnated fiberglass cloth is 0.35-0.4 mm. The monolithic solenoids are subject to conditioning. The number of times the solenoids switch to the normal state during this conditioning process depends on the solenoid dimensions. As the dimensions increase, the number of transitions required to reach the critical current of the solenoid increases. Monolithic solenoids, especially those fabricated from cables with relatively homogeneous resistance, have relatively high critical characteristics.

### PROTECTIVE STRUCTURES AND EQUIPMENT

**22010** (RFP—2433) **Quantitative respirator man-testing at Rocky Flats.** Leigh, J.D. (Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant). [nd]. Contract EY-76-C-04-3533. 6p. Dep. NTIS, PC A02/MF A01.

The dioctyl phthalate quantitative respirator man-testing method used at Rocky Flats is outlined. Using this method, 93 persons trained to use self contained breathing equipment were tested with eight respiratory protective devices. Test results obtained with the seven devices using high efficiency particulate filters are compared to the results obtained with the self contained breathing equipment. Also comparison is made for these results to test results for 1667 other employees.

## HANDLING EQUIPMENT AND PROCEDURES

**22011** (DP-MS—77-49) **Pulsed reactivity measurements of large $^{235}$U—Al castings in $H_2O$.** Pellarin, D.J.; Jarriel, J.L. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). 1977. Contract EY-76-C-09-0001. 14p. (CONF-771109—70). Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

The safe storage and handling of large $^{235}$U-Al castings at the Savannah River Plant are assured by limiting the number of fuel pieces and their spacing such that the k/sub eff/ calculated by KENO-IV with Hansen-Roach cross sections does not exceed some conservative limit with complete, accidental water immersion. For economic reasons, the conservative limit on the calculated k/sub eff/ is generally chosen as high as possible consistent with an accurate knowledge of the margin of error in the k/sub eff/ calculation. The margin of error for arrays of large, hollow cylinders of highly enriched $^{235}$U-Al alloy fuel in $H_2O$ is presented. The subcritical reactivities were derived from pulsed neutron measurements. The measurements are extended to castings with 17.39 kg $^{235}$U/m, the pulsed experiments are more accurately analyzed by the $\alpha v^{-1}$ method, and measurements for both 7-assembly hexagonal and 2 x 3 square pitch lattices are compared with KENO-IV calculations.

**22012** (MLM—2447) **Safety Analysis Report for Packaging (SARP): USA/9507/BLF (ERDA—AL), Model AL-M1.** Watkins, R.A.; Bertram, R.E.; Blauvelt, R.K.; Edling, D.A.; Flanagan, T.M.; Griffin, J.F.; Rhinehammer, T.B. (Mound Lab., Miamisburg, Ohio (USA)). 30 Sep 1977. Contract EY-76-C-04-0053. 190p. Dep. NTIS, PC A08/MF A01.

The SARP includes structural integrity, thermal resistance, radiation shielding and radiological safety, nuclear criticality safety, and quality control of three insulated drum shipping containers identified as USA/9507/BLF (ERDA-AL), also called AL-M1, configurations 1, 3, and 5. Complete physical and technical descriptions of the packages are presented. Each package consists of an inner container centered within an insulated steel drum. The contents are plutonium-239 and uranium-235 in configurations-1 and -3. The configuration-5 package is intended for shipment of up to 100,000 Ci of tritiated water immobilized on a sorbent such as molecular sieve. (TFD)

## SHIPPING CONTAINERS

*REFER ALSO TO CITATION(S) 21162*

**22013** (BNWL—2260-3) **Study of plutonium oxide leak rates from shipping containers. Quarterly progress report, April 1, 1977—June 30, 1977.** Schwendiman, L.S.; Pobereskin, M.; Mishima, J.; Sutter, S.L.; Madia, W.J.; Schmidt, E.W.; Drenner, D.C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1977. Contract EY-76-C-06-1830. 33p. Dep. NTIS, PC A03/MF A01.

The study was initiated in October, 1976. Several tasks are to be undertaken in the study. In combination, they have the end objective of defining the leak rates of plutonium oxide powder from characterized leaks. This is the third quarterly report of this work. Previous reports were issued as BNWL-2260-1 and -2. Progress on each of the tasks is reported. (TFD)

## TRANSPORT AND STORAGE FACILITIES

**22014** **Pipeline for transportation of solids: a reality.** Choudhury, A. *J. Inst. Eng. (India), Chem. Eng. Div.;* **57**: 117-121(Jun 1977).

The relatively simple problem of the flow of a Newtonian fluid in a pipe is still not wholly understood. Two component flows are even more complicated. Although solid pipelines have been in operation for more than 50 years, it was the ingenuity of those engineers who had practical concepts, a realistic approach, common sense, intuition and a rule of thumb who made these pipelines work successfully. Although many advancements have been made in this direction through experimental verification and establishing criteria, the competence of the engineer still remains the governing factor in successful implementation of such a transportation system.

## MINING AND DRILLING EQUIPMENT AND FACILITIES

*REFER ALSO TO CITATION(S) 20977*

**22015** (STU—75-5234) **Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps.** Sellgren, A. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Dept. of Hydraulics). Apr 1977. 52p. Dep. NTIS (US Sales Only), PC A04/MF A01.

The trend in mining is toward giant open pit mines because of their suitability for mechanization and highly productive mining. To compete with ore from such mines, new ways of working and transporting ore from underground mines must be found. A hydraulic hoisting system represents a relatively low investment cost in comparison with conventional shaft hoisting. The operational cost will be about the same, provided that the ore is ground to about 1 mm. The chief advantage of hydraulic hoisting is that the hoisting capacity can be increased without the necessity of sinking new shafts. By sinking a pipe near the ore-bearing area, one can better utilize the existing underground haulage system. The principal drawback of hydraulic hoisting of coarse heavy ores is the relatively low efficiency. The pilot-plant study was carried out with coarse iron ore (6 mm) taken from in-plant processing and the ore concentration by volume was up to about 25% in the vertical transportation in a pipe of diameter = 0.094 m. Within the limitations of this work it was found that: it is necessary to use fresh mineral to eliminate one possible uncertainty in the interpretation of test-loop data to a once-through industrial application; the nature of solid-liquid flow causes added error, plugging, and failure of many conceivable instruments, and special attention must therefore be given to the hydraulic control in a full-scale application; the friction losses obtained from a pseudohomogeneous approach represent best the losses in a once-through vertical pipe system in practise; and the clear water heat and efficiency curves of the centrifugal slurry pump was lowered from 30 to 35%. It is believed that the same type of hydraulic transportation as used for land-based underground mines can be applied in future exploitation of Swedish consolidated undersea deposits.

**22016** (Y/OWI/SUB—77-22324(Vol.2)(App.)) **Emplacement hole drill evaluation and specification study. Volume II. Appendices.** (Foster-Miller Associates, Inc., Waltham, Mass. (USA)). 30 Sep 1977. Contract W-7405-ENG-26. 201p. MF A01.

Portions of document are illegible.

This appendix contains pertinent data sheets, drawings, and photographs provided by the drill manufacturers Acker Drill Co, Calweld, Dresser Industries, Gus Pech, Hughes Tool, Ingersoll-Rand, Robbins, and Subterranean Tools.

# LASERS

*REFER ALSO TO CITATION(S) 22637, 22643, 22645, 22655, 22664, 22666, 22673*

**22017** (AD-A—042504) **Medium homogeneity in a chemical laser cavity using a lateral shearing interferometer. Technical report.** Jones, R.W.; Hales, W.L. (Army Missile Research Development and Engineering Lab., Redstone Arsenal, Ala. (USA). Army High Energy Laser Directorate). Jan 1976. 26p. (RH—76-7). NTIS PC A03/MF A01.

This report is a study of recent chemical laser tests which incorporated a real-time flow visualization diagnostic for observing flow field conditions in the chemical laser cavity. Of particular interest in this study is the use of a holographically constructed lateral shearing interferometer to calculate refractive index variations in the flow.

**22018** (COO—4030-4) **Laser discharges in attaching gases, June 25, 1976—June 24, 1977. Final report.** Rogoff, G.L.; Kline, L.E.; Pack, J.L.; Kasner, W.H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Research and Development Center). Sep 1977. Contract EY-76-C-02-4030. 67p. Dep. NTIS, PC A04/MF A01.

A significant problem in the development of high-power gas discharge lasers is the glow-to-arc transition, which limits the electrical energy that can be deposited in the diffuse glow plasma, especially in attaching gases. A combined experimental and theoretical study of the maintenance and stability of glow discharges in attaching gas mixtures similar to those used in rare gas-halide excimer laser discharges is described. A discharge test apparatus has been constructed for establishing uv-preionized, self-sustained, diffuse glow discharges in halogen-containing mixtures. Quasi-steady, diffuse discharges have been established in 0.5% $SF_6$:15-15% Kr:He mixtures at 100-800 Torr, and have been maintained for up to 1 μsec, the limit of the pulse-forming network used. Measured electric fields in the positive column agree well with fields calculated from a steady-state model based on electron production by one- and two-step electron impact ionization and loss by attachment to $SF^6$. The discharge duration is limited above some values of pressure, Kr concentration, and/or current density by the glow-to-arc transition, i.e., by filament formation within the diffuse glow. Discharge operation is not limited by the instability analyzed by Daugherty, Mangano, and Jacob.

**22019** (COO—4251-4) **Efficient high energy infrared third harmonic generation in gases and liquids for laser fusion applications. Quarterly progress report, September 1, 1977—November 30, 1977.** Kildal, H.; Brueck, S.R.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Dec 1977. Contract ES-77-S-02-4251. 8p. Dep. NTIS, PC A02/MF A01.

During this reporting period the process of laser induced breakdown in cryogenic liquid media appropriate to the tripling process has been investigated. The purpose of this study has been both to provide necessary parameters for determining optimum experimental geometries for scaling to third harmonic conversion efficiencies higher than the 2 percent level presently achieved and to gain more insight into the breakdown process itself. The latter should be of help in developing techniques for raising the breakdown threshold. We have also completed the design of a Dewar with a 1 m liquid path length and have almost finished the construction of a short pulse $CO_2$ laser facility; both of these experimental changes should lead to higher third harmonic conversion efficiencies.

**22020** (N—77-26478) **Investigation of possibilities for solar powered high energy lasers in space. Final report.** Rather, J.D.G.; Gerry, E.T.; Zeiders, G.W. (Schafer (W.J.) Associates, Inc., Arlington, Va. (USA)). 25 May 1977. Contract NASW-3048. 48p. (NASA-CR—153271; REPT—77SR-VA-U3). NTIS PC A03/MF A01.

The feasibility of solar powered high energy lasers in space has been studied. Preliminary analysis indicates that both direct and indirect pumping methods lead to high energy lasers having interesting efficiencies and capabilities. Many topics for further research have been identified.

**22021** (N—77-26479) **Nuclear pumped laser. II. Final contractor report, August 1975—August 1977.** Deyoung, R.J.; Lee, J.H.; Pinkston, W.T. (Vanderbilt Univ., Nashville, Tenn. (USA). Dept. of Physics and Astronomy). Aug 1977. 39p. (NASA-CR—153292; VU-PL—7/77). NTIS PC A03/MF A01.

The first direct nuclear pumped laser using the He-2-(n,p) H-3 reaction is reported. Lasing took place on the 1.79 micrometers Ar I transition in a mixture of He-3-Ar at approximately 600 Torr total pressure. It was found that the electrically pulsed afterglow He-Ar laser had the same concentration profile as the nuclear pumped laser. As a result, nuclear lasing was also achieved in He-3-Xe (2.027 micrometers) and He-3-Kr (2.52 micrometers). Scaling of laser output with both thermal flux and total pressure as well as minority concentration has been completed. A peak output (He-3-Ar) of 3.7 watts has been achieved at a total pressure of 4 atm. Direct nuclear pumping of He-3-Ne has also been achieved. Nuclear pumping of a He-3-$NF_3$ mixture was attempted, lasing in FI at approximately 7000 A, without success, although the potential lasing transitions appeared in spontaneous emission. Both $NF_3$ and $^{238}UF_6$ appear to quench spontaneous emission when they constitute more than 1% of the gas mixture.

**22022** (N—77-26490) **Experimental determination of the contrast of two interfering argon laser beams.** Pfeifer, H.J.; Mainone, D. (Institut Franco-Allemand de Recherches de Saint-Louis, 68 (France)). 14 Jun 1976. 18p. (ISL-R—116/76). NTIS PC A02/MF A01.

The contrast of two interfering partial beams from an argon-ion laser was measured as a function of the optical path difference and the output level in order to determine coherence length with a view to application to laser anemometry. The laser was operated without internal Fabry-Perot standard. The coherence properties at 488.0 nm were found to be better than at 514.5 nm. At maximum output level the loss of contrast was 10% for an optical path difference less than 1.5 cm.

**22023** (PB—269777) **System for calibrating laser power meters for the range 5-1000 W.** West, E.D.; Schmidt, L.B. (National Bureau of Standards, Boulder, Colo. (USA). Electromagnetics Div.). May 1977. 31p. (NBS-TN—685). NTIS PC A03/MF A01.

This technical note describes the National Bureau of Standards measurement system for calibration and test of laser power and energy devices at power levels up to 1 kW and total energies of several kJ. The main parts of the system are two electrically calibrated calorimeters and several beam splitters of different materials. The two calorimeters have the same precision, and the standard deviation of an electrical calibration is the same as the standard deviation of a laser energy measurement, indicating that the laser beam does not affect the precision of the measurement. The standard deviation of an energy measurement depends on the total energy to the calorimeter and is about 0.8 percent at 1 kJ.

**22024** (UCID—17629) **Review of photo-pumped short wavelength lasers.** Hagelstein, P.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1977. Contract W-7405-ENG-48. 74p. Dep. NTIS, PC A04/MF A01.

Thirteen papers dated from 1967 to 1977 on photoionization-pumped laser schemes and eight papers dated from 1974 to 1977 on schemes involving photoionization and photoexcitation are reviewed. (TFD)

**22025** (UCRL—13762) **Laser pump development. Final report.** (Hughes Aircraft Co., Culver City, Calif. (USA)). Jun 1977. 22p. Dep. NTIS, PC A02/MF A01.

The report summarizes the work and discusses results of a dye laser pump program to design and demonstrate several advanced technology concepts for increasing the efficiency of high power laser dye pumps and the use of the YAG laser as a source of the high frequency (0.53 $\mu$m) pump radiation. The overall objective of the program was to demonstrate the feasibility of operating a high efficiency frequency doubling (FD), 1.06 to 0.53 $\mu$m, unit in a high average power mode and to show that high frequency green (0.53 $\mu$m) outputs suitable for dye laser pumping can be produced through the use of FD techniques developed at Hughes. Specific goals included the production of 20 W average power per port for 6 h of operating time, amplitude uniformity that holds variations in pulse energy to less than 5% of the average pulse energy and beam pointing stability of 250 $\mu$m radians. The beam divergence objective was 7 $\mu$mr, with a stability of 20%. Accomplishments in general more than satisified contract requirements. The delivery of 35 watts average output power was demonstrated. Electrical efficiency was 0.5%. The beam divergence remained at 7 milliradians for the entire operating period. Pulse repetition rates are variable from 10 to 20 kHz and pulse width from 150 to 300 ns depending on the repetition rate. With a selected crystal and using electro-optical tuning (EOT) the energy per pulse did not vary by more than 10% of the average pulse energy. Moreover, most of this variation is attributable to a 120 Hz power supply ripple which is easily eliminated. (TFD)

**22026** (UCRL—80419) **Damage history of Argus, a 4TW Nd-glass system.** Stowers, I.F.; Patton, H.G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Dec 1977. Contract W-7405-ENG-48. 26p. (CONF-771061—4). Dep. NTIS, PC A03/MF A01.

From Symposium on optical materials for high power lasers; Boulder, CO, USA (4 Oct 1977).

Argus is a twin beam, 20 cm output aperture, Nd:glass laser system that has delivered 4TW to a laser fusion target. This performance is based on the concepts that multiple spatial filtering can prevent beam fill factors. Damage to optics due to self focusing and filamentation does not occur on Argus. The only form of damage is induced by broadband radiation from xenon flashlamps interacting with contaminants on or in the Nd:glass. The severity of damage is measured by the fraction of the beam obscured by the damage sites. This averages 0.1% per surface or 0.75% per arm. The amount of damage does not appear to be strongly related to the number of amplifier firings and generally occurs during the first few firings.

**22027** **High-intensity transmission characteristics of $CH_3$-$CHF_2$ and CHFCHF.** Kung, R.T.V.; Sirchis, M. (Avco Everett Research Laboratory, Inc., 2385 Revere Beach Parkway, Everett, Massachusetts 02149). *Appl. Phys. Lett.;* **32**: No. 4, 206-208(15 Feb 1978).

The high-intensity transmission characteristics of $CH_3CHF_2$ and CHFCHF were investigated in the intensity range of 5 x $10^6$ to 5 x $10^8$ W/cm$^2$ for various lines of the $CO_2$ lasing branches. For similar gas pressures, the ratio of small to large intensity absorption coefficients is relatively constant at various $CO_2$ lasing lines. The ratio of $\sim$6 measured for $CH_3CHF_2$ at 10.6 $\mu$m renders this molecule a good candidate for $CO_2$ amplifier gain isolation.

**22028** **Stimulated emission at 9.75 $\mu$m following two-photon excitation of methyl fluoride.** Prosnitz, D.; Jacobs, R.R.; Bischel, W.K.; Rhodes, C.K. (Department of Engineering and Applied Science, Yale University, New Haven, Connecticut 06520). *Appl. Phys. Lett.;* **32**: No. 4, 221-223(15 Feb 1978).

Stimulated emission at 9.75 $\mu$m has been observed in $^{12}CH_3F$, corresponding to the $2\nu_3 \rightarrow \nu_3$ transition, subsequent to two-photon excitation with $CO_2$ laser radiation. Results are presented for the dependence of laser output power as a function of $^{12}CH_3F$ pressure, and for a fixed amount of methyl fluoride, as a function of $D_2$ and Ne diluent pressures.

**22029** **Transient behavior of a nonlinear Fabry-Perot.** Bischofberger, T.; Shen, Y.R. (Physics Department, University of California, Berkeley, California 94720). *Appl. Phys. Lett.;* **32**: No. 3, 156-158(1 Feb 1978).

We have carried out a theoretical and experimental study on the transient characteristics of a nonlinear Fabry-Perot filled with Kerr liquid. Agreement between theory and experiment is excellent. Characteristic curves for the steady-state operation are deduced.

**22030** **Multilayer light scattering and the laser gyro.** Scott, M.L.; Elson, J.M. (Physics Division, Michelson Laboratory, Naval Weapons Center, China Lake, California 93555). *Appl. Phys. Lett.;* **32**: No. 3, 158-161(1 Feb 1978).

Calculations of the angular distributions of scatter have been carried out using an exponential autocorrelation function for the

roughness at the interfaces of a multilayer dielectric mirror. This vector scattering theory indicates that techniques are available to reduce scatter levels.

**22031 Spectral tuning of ArF and KrF discharge lasers.** Loree, T.R.; Butterfield, K.B.; Barker, D.L. (University of California, Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, New Mexico 87545). *Appl. Phys. Lett.;* **32**: No. 3, 171-173(1 Feb 1978).

Simple prism tuning of a well-passivated double-discharge excimer laser has resulted in tuning ranges of better than 20 A in both ArF and KrF. Neither tuning is continuous, being interrupted by nonlasing holes in regions of self-absorption. A two-prism dispersive chain results in a linewidth of 1—2 A for KrF and less than 0.5 A for ArF.

**22032 Infrared four-wave sum and difference frequency generation in liquid CO-$O_2$ mixtures.** Kildal, H.; Brueck, S.R.J. (Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts 02173). *Appl. Phys. Lett.;* **32**: No. 3, 173-176(1 Feb 1978).

Four-wave sum and difference frequency generation of the outputs of two $CO_2$ TEA lasers are demonstrated in liquid CO-$O_2$ mixtures at 77 K. The efficiencies of these processes are enhanced by a two-photon resonance with the CO vibrational mode. A study of the polarization dependence and the line shape of the two-photon resonance is reported together with measurements of the mixing efficiencies. The difference frequency generation process can be phase matched using noncollinear phase matching.

**22033 Further assignments for the far-infrared laser transitions of HCN and $HC^{15}N$.** Maki, A.G. (Molecular Spectroscopy Section, Optical Physics Division, National Bureau of Standards, Washington, D.C. 20234). *J. Appl. Phys.;* **49**: No. 1, 7-11(Jan 1978).

Assignments are given for the 13 $H^{12}C^{14}N$ and 4 $H^{12}C^{15}N$ laser transitions that have not yet been identified. Although 10 different vibrational systems give rise to 27 laser transitions for $H^{12}C^{14}N$ and $H^{12}C^{15}N$ combined, all follow the same basic pattern involving a particular Coriolis interaction and a population inversion between stretching and bending vibrational manifolds. The laser transitions involve rotational states up to J=48, which is higher than has been observed in room-temperature spectra.

**22034 Scaling a double-pulsed copper chloride laser to 10 mJ.** Nerheim, N.M.; Vetter, A.A.; Russell, G.R. (Jet Propulsion Laboratory, Pasadena, California 91103). *J. Appl. Phys.;* **49**: No. 1, 12-15(Jan 1978).

By use of low-inductance (0.5 $\mu$H) discharge circuits, pulses of 9.6 mJ were obtained from a double-pulsed CuCl laser. An oscillator-amplifier configuration produced a pulse energy of 11 mJ. Scaling studies indicate that additional increases in the laser energy could be obtained by increasing the discharge voltage above 20 kV and/or by increasing the laser-tube dimensions.

**22035 Optically pumped molecular lasers in the 11—17-$\mu$m region.** Tiee, J.J.; Wittig, C. (Electrical Engineering Department, University of Southern California, University Park, Los Angeles, California 90007). *J. Appl. Phys.;* **49**: No. 1, 61-64(Jan 1978).

A large number of laser transitions in the 11—17-$\mu$m region have been obtained by optically pumping $CF_4$, NOCl, $CF_3I$, and $NH_3$ with a single line-tunable $CO_2$ TEA laser. These lasers have respectable conversion efficiency and can be scaled to high energies in a spectral region where the selective excitation of molecules is prerequisite to performing selective photodissociation and laser-induced chemistry experiments.

**22036 Optical rise-time measurements on KD*P transmission-line Pockels cells.** Johnson, B.C.; Guinn, K.R.; Martin, W.E.; Fountain, W.D. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *J. Appl. Phys.;* **49**: No. 1, 75-80(Jan 1978).

A technique has been developed for determining the optical-transmission rise times of subnanosecond switching KD*P electro-optic modulators. Optical streak-camera data with 15-psec overall resolution and 30-psec resolution electrical sampling measurements taken on several commercial devices are reported.

**22037 Effect of laser dye deterioration on performance.** Hammond, P.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Appl. Phys.;* **14**: No. 2, 199-203(Oct 1977).

Loss of gain in a dye medium as a result of decomposition by pump photons is considered in terms of disappearance of dye molecules and the appearance of a new, single chemical product having absorption in the fluorescence band. The cases of small signal gain and saturated gain are applied to a single pass through a transversely excited amplifier. Loss of output, defined as 'quantum yield of laser deterioration', Qsub(L), is related to the true quantum yield of molecular destruction of the dye, Qsub(M), and other known parameters.

**22038 Argon laser with wall stabilized transverse discharge.** Schaefer, G.; Salk, J.; Eichler, H.J.; Eichler, J. (Technische Univ. Berlin (Germany, F.R.). Optisches Inst.). *Appl. Phys.;* **14**: No. 2, 193-197(Oct 1977).

Planar and cylindrical discharges for argon lasers are compared by plasma theoretical calculations. The maximum laser output power available in the two arrangements is computed in dependence of various parameters neglecting saturation mechanisms. A transvers discharge arrangement confining the positive column by two parallel walls is described and experimental laser threshold values for the current and pressure are reported.

**22039 Tunable laser via $F^+_2$ and $F^-_2$ colour centers in the spectral region 0.88-1.25 $\mu$m.** Gusev, Yu.L.; Marennikov, S.I.; Chebotayev, V.P. (AN SSSR, Novosibirsk. Inst. Fiziki Poluprovodnikov). *Appl. Phys.;* **14**: No. 1, 121-122(Aug 1977).

Frequency-tunable generation by means of $F_2^+$ and $F_2^-$ color centers in a LiF crystal is reported. Color centers were created by illuminating LiF crystals with electrons of 3 meV energy at the electron current density of 1 $\mu A/cm^2$. The pumping source was a ruby laser with a peak power of 20 MW, a pulse duration of 20 ns, and a repetition rate of 1 Hz. The frequency tuning is obtained in the range of 0.88-1.25 $\mu$m. Discussed are the ways of pumping of color centers and the possibility of lasing in the spectral region of 0.85 to 2 $\mu$m in the type of color centers under investigation.

**22040 Magnetic tuning system for dye lasers.** Winkler, K.; Kowalski, J. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.). *Appl. Phys.;* **14**: No. 1, 25-28(Aug 1977).

A new device for magnetically displacing the output mirror of a laser resonator and synchronously tilting an etalon in order to obtain single-mode tuning of a dye laser over a tuning range of at least 10 GHz is described. Comparatively large displacements with good linearity of a coil mounted on a membrane and placed inside the strong magnetic field of a ring magnet are obtained for currents in the order of several hundred milliamperes. Together with etalon flats of appropriate thickness and reflection mounted in the resonator of the laser a versatile instrument for application in intra and extra spectroscopy has been developed.

**22041 Gasdynamic laser using a $D_2$—HCl—He mixture.** Oraevskii, A.N.; Pimenov, V.P.; Rodionov, N.B.; Schchelov, V.A. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. J. Quant. Electron. (Engl. Transl.);* **7**: No. 8, 957-960(Aug 1977).

Gasdynamic lasers using a $D_2$—HCl—He mixture are discussed theoretically. A numerical analysis is used to investigate in detail the dependence of the gain on the initial parameters, nozzle contour, and mixture composition. It is found that, under the optimum operating conditions, the gain can reach values of $10^{-2}$—$10^{-1}$ $cm^{-1}$.

**22042 Kinetics of stimulated emission of excimer radiation from inert gases in a nonself-sustained electric discharge.** Voitik, M.G.; Molchanov, A.G.; Popov, Y.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. J. Quant. Electron. (Engl. Transl.);* **7**: No. 8, 976-980(Aug 1977).

A kinetic equation is solved to determine the distribution of the electric discharge power between elastic and inelastic electron collisions in argon, krypton, and xenon. The kinetics of the excimer emission is studied for krypton allowing for the processes of deactivation. An expression is derived for the growth time of a step-ionization instability which is found to be inversely proportional to the square root of the power supplied to the discharge. The maximum efficiencies and gain factors are found for inert-gas excimer lasers.

**22043 Investigation of Zeeman beats in a two-mode traveling-wave laser.** Nazarenko, M.M.; Savel'ev, I.I.; Skulachenko, S.S.; Khromykh, A.M.; Yudin, I.I. *Sov. J. Quant. Electron. (Engl. Transl.);* **7**: No. 8, 984-989(Aug 1977).

A report is given of experimental and theoretical investigations of the sum of frequencies of the Zeeman beats of opposite waves in a two-mode He—Ne traveling-wave laser ($\lambda$=1.15 $\mu$) with a circularly anisotropic resonator. It is shown that in a fairly wide range of detuning near the maximum of the gain curve the sum of the beat frequencies is proportional to the detuning. The coefficient of proportionality (magnetic sensitivity function) is considered as a function of the magnetic field applied to the active medium, excess of the gain over the losses, and pressure in the He—Ne mixture. The results can be used in the design of frequency-stabilized traveling-wave lasers.

**22044 Dynamics of stimulated emission from an electron-beam-controlled $CO_2$ laser with a plasma mirror.** Basov, N.G.; Boiko, V.A.; Danilychev, V.A.; Zvorykin, V.D.; Lobanov, A.N.; Suchkov, A.F.; Kholin, I.V.; Chugunov, A.Y. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. J. Quant. Electron. (Engl. Transl.);* **7**: No. 8, 998-1003(Aug 1977).

An investigation was made of the dynamics of the stimulated emission from an electron-beam-controlled $CO_2$ laser with a plasma

mirror. Two limiting cases were considered: stimulated emission of a single pulse of ~100 nsec duration (laser radiation energy up to ~250 J) and stimulated emission of a train of nanosecond pulses (power up to ~20 GW). The operation of the laser was modeled numerically.

**22045 Microwave-pumped helium—neon laser.** Muller, Y.N.; Geller, V.M.; Lisitsyna, L.I.; Grif, G.I. (Electrical Engineering Institute, Novosibirsk). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1013-1015(Aug 1977).

An analysis was made of possible advantages of a microwave-pumped He—Ne laser. It was found experimentally that the use of a microwave discharge in a He—Ne laser lowered the threshold pump power, increased the laser output power, and reduced the length of the active medium.

**22046 Some features of weak Q switching in a ruby laser resonator.** Zhiryakov, B.M.; Popov, N.I. (Engineering-Physics Institute, Moscow). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1015-1016(Aug 1977).

An experimental investigation was made of the influence of weak passive Q switching in a spherical resonator on the output characteristics of a ruby laser. The caustic section of the resonator was covered partly with a glass filter. Variation of the covered area made it possible to obtain a range of stimulated emission regimes from quasicontinuous to periodic pulsations.

**22047 Gasdynamic laser using a CO—Ar mixture.** Andronov, G.A.; Armer, A.G.; Belavin, V.A.; Dymshits, B.M.; Koretskii, Y.P.; Sharkov, V.F. *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1023-1024(Aug 1977).

The results are presented of investigations of a gasdynamic laser using CO—Ar mixtures. An output power of 20 W, a specific output energy of 5.9 J/g, and an efficiency of 0.5% were achieved. Information is given on the attainment of laser emission from pure carbon monoxide.

**22048 High-power pulse $NH_3$ laser pumped optically by $CO_2$ laser radiation.** Vasil'ev, B.I.; Grasyuk, A.Z.; Dyad'kin, A.P. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1027-1028(Aug 1977).

An investigation was made of the energy, temporal, and spatial characteristics of an $NH_3$ laser emitting at wavelengths 12.08 and 12.81 μ. An improved optical system and optimization of the operation of the $NH_3$ laser made it possible to obtain an energy of 0.35 J per pulse. The peak output power of this laser was ≅0.5 MW and its efficiency was ≅8%.

**22049 Neodymium-glass disk amplifier.** Borisov, B.N.; Vasil'ev, L.A.; Datsykov, S.V.; Karnaukh, N.P.; Kirsanov, V.P.; Kruzhilin, Y.I.; Lagun, V.N.; Orlov, V.K.; Troshkin, S.V.; Filippov, V.I. *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1030-1031(Aug 1977).

A description is given of the design of a neodymium-glass disk amplifier with an active medium of volume ~1.5 x $10^4$ $cm^3$ and a total stored energy of ~7.5 kJ. The results of tests on the amplifier are given and it is reported that the maximum gain is a factor of ~3.3.

**22050 Investigation of the energy characteristics of a copper vapor laser with a longitudinal discharge.** Bokhan, P.A.; Solomonov, V.I.; Shcheglov, V.B. (Institute of Atmospheric Optics, Siberian Branch, Academy of Sciences of the USSR, Tomsk). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1032-1033(Aug 1977).

An experimental investigation was made of the energy output of a copper vapor laser on the parameters of a longitudinal gas discharge. A high-temperature heater was used in the discharge tube. An increase in the rate of rise of the current density revealed a tendency of the energy output to reach saturation but this tendency was much weaker when the amplitude of the voltage across a "sharpening" capacitor was increased (at least up to 10 kV). The optimal value of the copper vapor pressure depended on the amplitude of the voltage across this capacitor.

**22051 Single-frequency GaAs injection laser.** Basov, N.G.; Kargapol'sev, V.S.; Malygin, E.P.; Malyshev, V.K.; Molochev, V.I.; Narzullaev, K.N.; Kikitin, V.V.; Semenov, A.S.; Talenskii, O.N. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1034(Aug 1977).

An experimental investigation was made of single-frequency GaAs injection lasers which were operated continuously at 77°K. The emission of a single longitudinal mode from a plane-parallel resonator was observed in a wide range of injection currents (up to a sevenfold excess over the threshold value) and the total output energy exceeded 50 mW.

**22052 Tunable single-frequency calcium—hydrogen laser emitting at 5.54 μ.** Klimkin, V.M.; Kolbycheva, P.D. (Institute of Atmospheric Optics, Siberian Branch, Academy of Sciences of the USSR, Tomsk). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1037-1039(Aug 1977).

An investigation was made of a cw single-frequency Ca—$H_2$ laser. The dependence of the output intensity on the resonator length was determined. The energy characteristics of a laser tunable by the application of a longitudinal magnetic field were investigated. Measurements were made with the resonance line of the resonator tuned continuously to the central frequency of a Zeeman component shifted by the magnetic field. The rate of shift was 1.41 +- 0.02 MHz/Oe.

**22053 Characteristics of n-GaP/sub x/As/sub 1-x/—p-Ga/sub 1-y/Al/sub y/P/sub x/As/sub 1-x/ heterojunction lasers emitting visible radiation.** Ismailov, I.; Shokhudzhaev, N.; Akhmedov, D.; Eliseev, P.G. (S. U. Umarov Physicotechnical Institute, Academy of Sciences of the Tadzhik SSR, Dushanbe). *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1039-1041(Aug 1977).

An investigation was made of the characteristics of single-sided n-GaP/sub x/As/sub 1-x/—p-Ga/sub 1-y/Al/sub y/P/sub x/As/sub 1-x/ (x=0.1—0.45) heterolasers grown by liquid epitaxy and emitting visible radiation. The lasers with $x<0.3$ were found to have threshold current densities in the range j/sub t/=2—3 kA/$cm^2$ at 77°K and 15—20 kA/$cm^2$ at 300°K. The dependence of j/sub t/ on the photon energy was determined at 77 and 300°K. The output power of the lasers with x=0.2—0.25 was 6—8 W per pulse (500 Hz repetition frequency, 0.1 μsec duration) at 77°K and 2—2.2 W at 300°K. A considerable increase in j/sub t/ and a fall of the output power were observed in the range $x>0.3$. The differential efficiency of the better lasers was 5—8% at 300°K and 20—25% at 77°K.

**22054 Gas-discharge CO laser with a high specific output energy.** Sharkov, V.F.; Dymshits, B.M.; Grigor'yan, G.M.; Ivanov, G.V.; Koretskii, Y.P.; Kochetov, I.V.; Lamonov, V.M.; Pevgov, V.G. *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1041-1042(Aug 1977).

An experimental and theoretical investigation was made of a longitudinal-discharge CO laser with a high continuous flow rate. The following output parameters were obtained experimentally for helium-enriched mixtures: specific output energy 550 J/g, efficiency 30%, small-signal gain 2 $m^{-1}$, continuous output power 700 W. Lasing with an efficiency of 20% was observed in a mixture with argon instead of helium. The calculation model proposed for the CO laser was in satisfactory agreement with the experiment.

**22055 Electron-beam-controlled laser with a grid-controlled electron gun.** Avanesyan, V.S.; Dutov, A.I.; Lakhno, Y.V.; Malkhov, L.N. *Sov. J. Quant. Electron. (Engl. Transl.);* 7: No. 8, 1043-1044(Aug 1977).

An experimental investigation was made of an electron-beam-controlled carbon dioxide laser with an electron gun in which the beam current was modulated by a control grid. The design features of the electron gun and laser are described and their performance is reported. Observations of instabilities of the electron beam in the gun are reported and methods for eliminating them are suggested.

**22056 Gallium arsenide and related compounds (Edinburgh), 1976.** Hilsum, C. (ed.). London; Inst. of Physics (1977). 445p. (CONF-7609141—). Inst. of Physics, New York.

From 6. international symposium on gallium arsenide and related compounds; Edinburgh, UK (20 Sep 1976).

Forty-eight papers were presented at the conference. Separate abstracts have been prepared for four of the papers considered to be in the subject scope for the DOE Energy Data Base. (TFD)

**22057 (GaAl)As—GaAs heterostructure lasers: factors affecting catastrophic degradation.** Henshall, G.D. (Standard Telecommunication Labs., Ltd., Essex, Eng.). pp 388-399 of In Gallium arsenide and related compounds (Edinburgh), 1976. Hilsum, C. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; Edinburgh, UK (20 Sep 1976).

See CONF-7609141—.

Catastrophic degradation in (GaAl)As-GaAs heterostructure lasers is characterized by an irreversible fall in output power together with associated facet damage. The importance of near-field uniformity in interpreting catastrophic degradation is described. The power emission per unit area should primarily determine the onset of catastrophic degradation. It is shown that when the effects of such factors as the near-field uniformity and internally circulating modes are taken into account, good agreement is obtained between the effective optical width and the limit of catastrophic degradation. This is demonstrated for the five-layer LGR structure where it is possible to tailor the far-field pattern width from 50 to 15°, while still retaining low threshold currents. It is now possible to predict the maximum safe operating level of a given laser without destructive measurements.

**22058 Optical studies of defects and degradation in GaAs—GaAlAs double-heterostructure laser materials.** Monemar, B.A.; Woolhouse, G.R. (IBM Thomas J. Watson Research Center, York-

town Heights, NY). pp 400-410 of In Gallium arsenide and related compounds (Edinburgh), 1976. Hilsum, C. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; Edinburgh, UK (20 Sep 1976).

See CONF-7609141—.

Results of a study of defects and degradation phenomena in GaAs-GaAlAs double-heterostructure (DH) laser wafers using optical excitation are reported. Analysis of defects in the active region of such wafers has been carried out using photoluminescence (PL) topography, together with transmission electron microscopy (TEM). Particular emphasis has been put on the identification of different mechanisms for dark-line defect (DLD) growth under optical excitation. Furthermore we have aimed at an identification of the particular initial defects in the wafer which give rise to a specific mode of degradation. We have observed that grown-in dislocations, such as, for example, those associated with stacking faults, cause rather slow degradation with a typical DLD growth rate of $\mu m\ h^{-1}$. We identify this mode with the formation of dislocation climb structure as observed by other workers. Dislocations created after crystal growth, on the other hand, were found to give rise to a novel very rapid ($50\ \mu m\ s^{-1}$) form of DLD growth. These DLDs are composed of <110> oriented dark lines, which, using TEM, have been identified as misfit dislocations at the interface between the p-ternary layer and the active region. Evidence that these dislocations are created by glide will be presented and the relevance of these results to the degradation of electrically operated lasers will be discussed.

**22059 Degradation characteristics of cw lasers with specific growth defects.** Pion, M.; Goodwin, A.R.; Kirkby, P.A.; Baulcomb, R.S. (Standard Telecommunication Labs. Ltd., Essex, Eng.). pp 411-418 of In Gallium arsenide and related compounds (Edinburgh), 1976. Hilsum, C. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; Edinburgh, UK (20 Sep 1976).

See CONF-7609141—.

In the course of a program aimed at developing reliable continuously operating lasers, lives in excess of 13,000 have been obtained and in addition it has been found that a high proportion of lasers degrade at very slow rates provided that they meet certain criteria of temperature stability and freedom from defects due to growth and processing. Selection of lasers to be free of defects results in a low yield on some wafers and it is important to establish how necessary such selection is. Surface defects appearing on double-heterostructure epitaxial layers grown for cw lasers have therefore been studied and related to subsequent observed laser life. Severe defects near or within the stripe, such as scratches or scratch pits, are found to lead to rapid degradation, although some exceptions are observed. Wipe-off pits which are shallow defects confined to the capping contact layer have been found not to affect degradation. The life behaviour of laser dice without visual defects is compared with that of dice exhibiting various types of growth defects.

**22060 TEM observations of dark defects in degraded gallium arsenide heterojunction lasers.** Dobson, P.S. (Univ. of Birmingham, Eng.); Hutchinson, P.W.; O'Hara, S.; Newman, D.H. pp 419-426 of In Gallium arsenide and related compounds (Edinburgh), 1976. Hilsum, C. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; Edinburgh, UK (20 Sep 1976).

See CONF-7609141—.

The defect structure of room-temperature degraded double-heterostructure gallium arsenide lasers, showing [100] dark lines, and accelerated life-tested lasers, showing [100] dark lines and dark spots, have been examined using transmission electron microscopy. The [100] dark lines are associated with extended [100] dislocation dipoles having a Burgers vector of $\frac{1}{2}$[110] type and lying on inclined [001] planes. The Burgers vector always lies perpendicular to the dipole habit plane and the direction of elongation is perpendicular to both the burgers vector and the [001] normal to the epitaxial layers. These results confirm that the dipoles grow by a climb mechanism. Each dislocation network consisted of a number of parallel dipoles which were linked by short segments lying on the (001) plane in the [110] direction. These arms were always connected to that part of the dipole lying closest to the n-type surface and it is concluded that the arms grow by a combination of climb and localized shear. Dark-line defects lying along [110] directions and black-spot defects have been observed in lasers subjected to accelerated aging tests. The [110] dark lines which run across the active stripe are associated with long dislocations lying in the vicinity of the substrate-GaAlAs interface. These dark-line defects show up in the electroluminescent output from the n-surface because of optical pumping of the substrate. The dark-spot defects are associated with defect structures containing dislocation loops which lie within the vicinity of the active layer.

**22061 Gallium arsenide and related compounds (St. Louis), 1976.** Eastman, L.F. (ed.). London; Inst. of Physics (1977). 366p. (CONF-7609148—). Inst. of Physics, New York.

From 6. international symposium on gallium arsenide and related compounds; St. Louis, MO, USA (26 Sep 1976).

Forty-one papers were presented at the conference. Separate abstracts have been prepared for four of the papers considered to be in the subject scope for the DOE energy Data Base. (TFD)

**22062 Discrete and distributed feedback buried heterostructure lasers.** Burnham, R.D.; Scifres, D.R.; Streifer, W. (Xerox Palo Alto Research Center, CA). pp 297-302 of In Gallium arsenide and related compounds (St. Louis), 1976. Eastman, L.F. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; St. Louis, MO, USA (26 Sep 1976).

See CONF-7609148—.

The paper discusses two buried double-heterostructure diode lasers. Both operate at room temperature. The first uses cleaved crystal facets to provide feedback as in conventional lasers. The second is a new device using a periodic structure to provide distributed feedback. This device operates in a single TE polarized longitudinal mode over a temperature range from 232 to 324 K and exhibits a temperature sensitivity of 0.72 A $K^{-1}$. In comparison, the variation for similar Fabry-Perot diode is 3.4 A $K^{-1}$. An alternative approach for improving buried heterostructure lasers is proposed. The scheme is to grow semi-insulating GaAlAs:Cr around the walls of the mesa.

**22063 In/sub 1-x/Ga/sub x/As/sub y/P/sub 1-y/-InP double-heterostructure lasers.** Rossi, J.A.; Hsieh, J.J.; Donnelly, J.P. (Massachusetts Inst. of Tech., Lexington). pp 303-310 of In Gallium arsenide and related compounds (St. Louis), 1976. Eastman, L.F. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; St. Louis, MO, USA (26 Sep 1976).

See CONF-7609148—.

The fabrication and performance of stripe-geometry room-temperature GaInAsP-InP cw lasers emitting at 1.15 $\mu m$ and pulsed lasers emitting at 1.24 $\mu m$ is described. These heterostructures were fabricated by liquid phase epitaxial growth on melt-grown InP substrates, and the stripes were defined by using proton bombardment to produce high-resistance current confinement layers. Room-temperature cw lasing is obtained on several different wafers covering the wavelengh interval $1.10 < \text{lambda} < 1.15\ \mu m$. Single-facet, external differential quantum efficiencies of > 20% and output powers of approximately 8 mW have been observed from the best devices.

**22064 Room-temperature visible In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/($x \leq 1, z \sim 0.6$) heterojunction lasers.** Coleman, J.J. (Univ. of Illinois, Urbana); Holonyak, N. Jr.; Chin, R.; Marshall, B.L.; Groves, W.O.; Herzog, A.H.; Keune, D.L. pp 339-345 of In Gallium arsenide and related compounds (St. Louis), 1976. Eastman, L.F. (ed.). London; Inst. of Physics (1977).

From 6. international symposium on gallium arsenide and related compounds; St. Louis, MO, USA (26 Sep 1976).

See CONF-7609148—.

The growth and properties of large-heterobarrier (ΔE approximately greater than 250 meV) In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/ double-heterojunction (DH) laser diodes that operate in the visible near the direct-indirect transition (x/sub c/-0.53z/sub c/ = 0.73, 300 K) are considered. Standard LED composition GaAs/sub 1-y/P/sub y/ (x approximately 1.0,y approximately 0.40,z approximately 0.60) can be incorporated (by LPE) as the active layer (red) between yellow-gap In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/(x approximately 0.71,z approximately less than 0.01) confining layers, thus forming DH laser diodes (lambda approximately 6650 A, j/sub th/ approximately 2.4 x $10^4$ A $cm^{-2}$, 300K). The limitations of these DH diodes owing to problems with crystal growth (LPE in a circular slider boat) are discussed.

**22065 Industrial applications of high power laser technology.** Ready, J.F. (ed.). Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1977). 167p. (CONF-760832—P2). .

From 20. annual SPIE technical symposium; San Diego, CA, USA (24 Aug 1976).

Twenty-three papers were presented at the conference. A separate abstract was prepared for nine of the papers. The remaining papers are not in scope for ERA. (TFD)

**22066 (ORNL-tr—4534) Yttrium aluminum garnet driving oscillator and formation of the spectral radiation composition of a powerful laser.** Zorev, N.N.; Sklinzkov, G.V.; Tsvetkov, M.Yu.; Shikanov, A.S. 1976. Translation of Preprint No. 149, P.N. Lebedev Order of Lenin Physical Institute, The Academy of Sciences of the USSR, Moscow, 1976, pp 1-15. 13p. Dep. NTIS, PC A02/MF A01.

The characteristics of formation of the radiation spectrum of a powerful laser are investigated using two types of oscillators:

neodymium glass and yttrium aluminum garnet (YAG). The yttrium aluminum garnet oscillator with a neodymium impurity oscillator with active fractional modulation is described. Its parameters are given and their value for the operation of a powerful laser is examined. It is shown that the detected, weak, directional emission of the yttrium aluminum garnet oscillator, broad spectrum, plays the dominant role in the formation of the spectral composition of emission during the conventional operating regime of the amplifier stages.

**22067 Second international and winter school on submillimeter waves and their applications.** Perkowitz, S. (ed.). New York; Institute of Electrical and Electronics Engineers (1976). 268p. (CONF-761209—).

From 2. international conference of submillimeter waves and their applications; San Juan, Puerto Rico (Dec 1976).

Digests of papers presented on the following topics are presented: Review of Submillimeter Ware Research; Fourier Transform Interferometry; Lasers, Optically Pumped Lasers; Lasers and Detectors; Submillimeter Sources Based upon Relativistic Electron Beam Phenomenology; Cosmic and Atmospheric Physics; Solid State Spectroscopy; Plasma Interactions, and Plasma Diagnostics. (TFD)

## HEAT TRANSFER AND FLUID FLOW

*REFER ALSO TO CITATION(S) 21036, 21515, 21591, 21658, 22089*

**22068** (UCRL—79770) **Modeling complex chemical reactions in flows with turbulent, diffusive mixing.** Patterson, G.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jul 1977. Contract W-7405-ENG-48. 18p. (CONF-771102—17). Dep. NTIS, PC A02/MF A01.

From 20. annual AICHE meeting; New York, NY, USA (13 Nov 1977).

Methods for modeling single chemical reactions in flows with turbulent mixing of reactants with specified or modeled degree of segregation have been demonstrated. Proposals for modeling such reactions (usually second order or of infinite rate) have also been presented and tested for turbulent mixing in the case of turbulent diffusion over large distances (diffusion of one component into another over distances much larger than the scale of segregation). These methods generally involve some sort of algebraic closure at some level of the correlation equations to be solved. That problem is complicated by the necessity to model the growth of segregation as the components mix on a macro-scale as well as its decay as components mix on a molecular scale. Complex reactions (consecutive and/or parallel) are very difficult to model with the closures proposed so far. A new method for modeling complex reactions in turbulent, diffusive mixing involves the simulation of the diffusion and mixing by coalescence-dispersion. In essence, the diffusion and mixing are modeled first by the usual finite difference techniques, then those model results are simulated by a coalescence-dispersion model which incorporates the correct site movement vectors to simulate the diffusion and convection and the correct coalescence and dispersion rates to simulate the mixing. It is then a simple matter to allow any set of reactions to proceed within the sites during each coalescence. Results of the new model show its feasibility for complex reaction systems.

**22069 Flow of heat between bodies in gas-filled contact.** Gibson, R.D.; Bush, A.W. (Teesside Polytechnic, Middlesbrough, Eng.). *Appl. Energy;* **3**: No. 3, 189-195(Jul 1977).

A mixed boundary value problem arising in the flow of heat between bodies where the interstices contain conducting gas is reduced to an integral equation. The integral equation is solved numerically and an asymptotic limit is considered.

**22070 Designing evaporative thermal siphons for use in thermoelectric devices.** Berdiev, M.G. (Dagestan Polytech Inst, USSR). *Appl. Solar Energy (USSR) (Engl. Transl.);* **13**: No. 2, 11-16(1977).

Results are reported for experimental investigations aimed at validating computational relationships; a method of designing evaporative thermal siphons for thermoelectric instruments is proposed. 11 refs.

**22071 Nucleate boiling at a liquid—liquid interface.** Moalem, D.; Zijl, W.; van Stralen, S.J.D. (Eindhoven Univ. of Tech., Netherlands). *Lett. Heat Mass Transfer;* **4**: No. 5, 319-329(1977).

Nucleate boiling at a liquid-liquid interface was investigated experimentally and theoretically. This concept of liquid-liquid boiling is based on the introduction of a heavier thin liquid layer with higher boiling temperature between the heating surface and the boiling bulk liquid (the light phase). If the two liquids are immiscible, stably stratified liquid layers are formed. When the solid surface at the bottom is heated, nucleation occurs at the liquid-liquid interface. Water and n-pentane were used as heavy and light phase, respectively. The experiments and phenomena of bubble growth and departure are described. Theoretical expressions for growth and departure are developed. The results in terms of bubble radius vs. time for boiling n-pentane at the water interface shows good agreement between calculated and experimental data. (LCL)

## MATERIALS TESTING

*REFER ALSO TO CITATION(S) 22257*

**22072 Role of ion aggregates in Rebinder-Westwood environmental effects on wear as monitored by acoustic emission.** Cuthrell, R.E. (Sandia Laboratories, Albuquerque, New Mexico 87115). *J. Appl. Phys.;* **49**: No. 1, 432-436(Jan 1978).

The acoustic-emission rate is shown to be a direct measure of wear rate in a brittle solid and is used to study the strong dependence of drilling rates on the fluid environment. It is proposed that aggregation of ions in the drilling fluid produces charged or noncharged species which determine the surface zeta potential. The Rebinder-Westwood environmental effects on mechanical properties correlate well with the zeta potential and it is shown that the effects also correlate well with the state of charge of ions and ion aggregates in the fluid environment.

**22073 Contrast reduction factor for object contrast assessment in neutron radiography.** Castagno, J.G.; Bull, S.R. (Univ. of Missouri, Columbia). *Trans. Am. Nucl. Soc.;* **27**: 209-210(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22074 Resonance energy neutron radiography techniques.** Oien, C.T.; Barton, J.P. (Oregon State Univ., Corvallis). *Trans. Am. Nucl. Soc.;* **27**: 210-212(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22075 Computerized axial tomography for neutron radiography of nuclear fuel.** Barton, C.F. (Oregon State Univ., Corvallis). *Trans. Am. Nucl. Soc.;* **27**: 212-213(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## SAFETY ENGINEERING

**22076 Flame resistance for plastics and chemical fibers.** Kirchmayr, R. (Ciba-Geigy A.G., Basel (Switzerland). Forschung Kunststoff-Additive). *Kunststoffe;* **66**: No. 10, 679-682(1976). (In German).

This brief survey records and describes the main possibilities for producing hard-to-burn plastics or for fire-proofing burnable plastics and chemical fibers. Four aspects are presented using examples according to which one can achieve this aim. Illustrations on the action mechanisms of the classical flame resistive medium from the halogen and phosphorous compound series as well as the antimony/halogen synergism supplement the discourse on hitherto obtained results and the present state of technology.

## ELECTRONIC CIRCUITS AND DEVICES

*REFER ALSO TO CITATION(S) 20926, 21836*

**22077** (BDX—613-1875) **Modification of SEC 3000 bonder for electronic flame-off.** Schroeder, D.D. (Bendix Corp., Kansas City, Mo. (USA)). Nov 1977. Contract EY-76-C-04-0613. 7p. Dep. NTIS, PC A02/MF A01.

Modifications described allow replacement of the standard hydrogen flame-off unit with an electronic unit which increases safety, eliminates expensive equipment, and increases consistency of operation.

**22078** (LA—6985) **Micro-NOVAC: an intelligent CAMAC controller based on a micro-NOVA computer.** Vanuxem, J.P. (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1977. Contract W-7405-ENG-36. 24p. Dep. NTIS, PC A02/MF A01.

A general-purpose, intelligent CAMAC controller based on the Data General micro-NOVA microcomputer is described. Making direct use of the micro-NOVA computer boards, the controller is fully software-compatible with the NOVA line of computers. As CAMAC becomes a more widespread standard in the labora-

tory and in industry, such a low-cost, high-performance controller should become popular. This report focuses on the CAMAC aspects of the controller; the computer aspects are covered in appropriate Data General Corp. manuals. 17 figures.

**22079** (SAND—77-1599) **Symmetrical $\pi$ and T attenuators: design data for component power dissipation and resistance.** Schaedla, W.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). Oct 1977. Contract EY-76-C-04-0789. 15p. Dep. NTIS, PC A02/MF A01.

The equations relevant to the selection of resistor values for symmetrical $\pi$ and T attenuator networks are presented. Equations defining the percentage of input power dissipated in each resistor of the network are derived. The dual aspects of symmetrical $\pi$ and T attenuators are discussed and the above results are summarized in easy to use graphical form.

**22080** (UCRL—13718) **High repetition rate spark gap. Final report.** (Maxwell Labs., Inc., San Diego, Calif. (USA)). Mar 1977. Contract W-7405-ENG-48. 45p. (MLR—640). Dep. NTIS, PC A03/MF A01.

Portions of document are illegible.

The objective of the program was to design, fabricate and test a high repetition rate spark gap to meet the following technical specifications: voltage—250 kV; applied voltage wave-voltage waveform above 150 kV for shape—2 μsec prior to firing; current—40 kA; pulse width—40 nsec; risetime—less than 10 nsec, with a 5 nsec goal; jitter—less than 5 nsec, with a 1 nsec goal; repetition rate—1000 Hz with 10 kHz goal; duty cycle—a burst of twenty 40 nsec-width pulses equally spaced at maximum frequency with a 4 sec off-time between bursts; and life—at least 1,000,000 pulses between servicing with goal of $10^7$. (TFD)

**22081** **Cancel 60 Hz and other noise.** Clark, G.A. (Univ. of California, Livermore). *Electron. Des.;* vp(27 Sep 1976).

The design of an adaptive filter that provides excellent noise reduction and gives less signal distortion than conventional filters is described. (TFD)

## WASTE PROCESSING PLANTS AND EQUIPMENT

*REFER ALSO TO CITATION(S) 22086*

**22082** (CONF-770235—, pp 27p, Paper 2) **Facility deficiencies.** 23 Feb 1977.

From Thermochemical coordination meeting-fuel from biomass program; Lubbock, TX, USA (23 Feb 1977).

In Fuels from biomass program: thermochemical coordination meeting.

A list of deficiencies pertaining to the Albany Waste-to-Oil Experimental Facility is presented. This list is divided into the following five groups: Group I. Design deficiencies: safety related and other; Group II. Approved plant modifications; Group III. Construction deficiencies: previously funded jobs and unfunded jobs (Maecon Corporation); Group IV. Unestimated and potential deficiencies: recognized unestimated deficiencies and potential problem areas; and Group V. Data, drawings, and manuals. Cost estimates are included. (JGB)

**22083** **No tipping: service included in waste burning plant.** *Processing:* **23**: No. 4, 41, 44-45(Apr 1977).

The municipal waste processing plant at West Midlands County, England is described. This facility shreds the wastes, recovers the ferrous scrap by magnetic separation, and feeds the remaining refuse to trucks. The trucks transport the refuse to a nearby industrial plant which burns the refuse as a supplementary fuel for its coal-fired boilers. The system has operated successfully for a year at a firing rate of 8 tons/h of refuse, and resulted in a 50% reduction in boiler fuel costs, while reducing the waste disposal costs to practically nothing after initial development costs. (LCL)

## COMBUSTION SYSTEMS

*REFER ALSO TO CITATION(S) 20923, 20924, 20925, 20927, 21842, 21850*

**22084** (CONF-770658—, pp 99-124) **Institutional boiler conversion.** Giammar, R.D. (Battelle Columbus Labs., OH). Nov 1977.

From Fuel switching forum; Pittsburgh, PA, USA (6 Jun 1977).

In Proceedings of the fuel switching forum.

Conversion of an oil-fired boiler to coal use is described. Factors to consider in conversion including space, costs, and operation are discussed. (JRD)

**22085** **Combustion heating apparatus to improve operation of gas pilot burners.** Eising, J.P. (to A. O. Smith Corp.). US Patent 4,059,386. 22 Nov 1977. Filed date 21 Jan 1976. 4p.

A gas pilot burner arrangement is described in which only air from the blower discharge plenum connected to the main gas burner is initially supplied to the pilot burner to mix with gas being supplied to the pilot burner through the pilot gas conduit. When a flame sensor is activated to prove that the pilot is lit, a valve is electrically activated to flow gas to the main burner and simultaneously provide a premix of raw gas and air to the pilot burner in addition to the gas admitted to the pilot through the pilot gas conduit.

**22086** **Fluidize to maximize.** Thorne, J.G.M. *Processing;* **23**: No. 4, 50-51(Apr 1977).

The principles of fluidized-bed combustion, applications in the UK including the use of fluidized-bed combustors in driers, calcinors, and incinerators, and the advantages in terms of lower levels of air pollution while burning lower quality fuels are discussed. (LCL)

**22087** **Effect of regeneration steam bleeding on economic efficiency of low-pressure steam turbine stages.** Simoyu, L.L.; Lugan, V.P.; Nakhman, Yu.V.; Markozov, N.D. (All-Union Heat Eng Inst, USSR). *Teploenergetika (Moscow);* No. 2, 35-39(Feb 1977). (In Russian).

Results of experimental investigations are presented and recommendations are given on improving the operation of low-pressure stages with steam bleeding. It is concluded that efficiency can be increased by adapting the post-bleeding stage to steam bleeding operating conditions. Above all, conditions of flow in the peripheral and root regions have to be improved.

**22088** **Effect of design characteristics of centrifugal injectors on liquid discharge coefficient.** Koval', V.P.; Bondarenko, V.I. (Dnepropetrovsk State Univ, Ukr SSR). *Teploenergetika (Moscow);* No. 2, 72-74(Feb 1977). (In Russian).

Results of experimental investigations are presented regarding the variation of the discharge coefficient of a centrifugal injector, depending on k under self-similar and nonself-similar conditons of operation, with the vortex chamber designed with conical recesses in the nozzle end face wall, and also depending on the position of admissioin ports and their number. A vortex chamber is recommended which has a recess on the end face wall with an angle of not more than 15°.

**22089** **Calculation of radiative heat transfer in a large gas fired furnace.** Khalil, E.E. (Imperial Coll. of Science and Tech., London); Truelove, J.S. *Lett. Heat Mass Transfer;* **4**: No. 5, 353-365(1977).

The heat transfer and local flow properties in a large gas fueled process heater are predicted using a calculation method based on a finite-difference numerical solution of the time-averaged equations governing the conservation of mass, momentum, chemical species and energy. Special attention is given to the modeling of radiant heat transfer. The accuracy of the predictions is assessed by comparison with experimental data. The comparison suggests that the calculation method can be used to obtain realistic predictions in practical gas fired furnaces.

## UNDERGROUND ENGINEERING

**22090** (BERC/TPR—78/1) **$NO_2$ levels in diesel exhaust.** Marshall, W.F. (Department of Energy, Bartlesville, Okla. (USA). Bartlesville Energy Research Center). Jan 1978. 8p. Dep. NTIS, PC A02/MF A01.

The safe operation of diesel-powered equipment in underground mines is predicated on there being sufficient ventilation to dilute the exhaust such that none of the toxicants in the dilute mixture exceed allowable levels. In order to determine the ventilation requirement for an engine, it is necessary to measure levels of the various toxicants in the exhaust. Measurements in the past typically either have excluded nitrogen dioxide or have not provided information on nitrogen dioxide specifically. Primarily this exclusion has resulted from lack of a fast, on-line analytical method. Development of the chemiluminescence analyzer appears now to provide the requisite capability; this instrument has been demonstrated to yield valid information for nitrogen dioxide levels and has been applied in a series of experiments conducted at the Department of Energy's Bartlesville (Okla.) Energy Research Center (BERC). Measurements of nitrogen dioxide in the exhaust from several diesel engines operated over wide ranges in speed and load were made as part of BERC's cooperative program with the U. S. Bureau of Mines. Results of these experiments indicate that nitrogen dioxide concentrations vary from less than 10% to approximately 30% of the total oxides of nitrogen. The nitrogen dioxide fraction was maximum at light load and decreased with increasing engine power. This trend was consistent for all five engines tested.

**22091 Time-dependent strain in rocks and its significance in mining.** Misra, A.K. (East Coalfields, Ltd, Sanctoria, India). *J. Mines, Met. Fuels;* **25**: No. 2, 33-38(Feb 1977).

Rocks, just like many other solid materials, exhibit time-dependent strains or "creep". An understanding of this phenomenon, which is encountered in the strata of mines, is important in the development of strata support and control techniques. This paper presents an account of the creep behaviour of rocks as observed by the author and others, and discusses its importance to mining. 10 refs.

## POLLUTION CONTROL EQUIPMENT

*REFER ALSO TO CITATION(S) 20922*

**22092 (PB—270112) Field testing: application of combustion modifications to control pollutant emissions from industrial boilers. Phases I and II (data supplement). Supplemental report for June 1973—September 1975.** Hunter, S.C.; Buening, H.J. (KVB Engineering, Inc., Tustin, Calif. (USA)). Jun 1977. Contract EPA-68-02-1074. 645p. NTIS PC A99/MF A01.

This data supplement records individual data points in greater detail than practical in the Phase I and II reports. It is intended for researchers who wish to refer to individual data points. Data are included from 47 boilers tested in Phase I, and 19 boilers tested in Phase II. The Supplement contains design data on the boilers tested, fuel sample analyses, control room data, gaseous emissions data (NO, $NO_2$, CO, $CO_2$, HC, $SO_2$, and $SO_3$), stack traverse data, particulate mass emissions and size, opacity readings, smoke spot numbers, and boiler efficiency. Additional details, including measurement procedures, boiler descriptions, and interpretations of the influence of combustion modifications on emissions and efficiency are contained in the Phase I and II reports.

**22093 Costly business of purifying noxious emissions.** *Processing;* **23**: No. 9, 48(Sep 1977).

Measures taken by BASF AG to minimize air pollution at its huge chemical production complex at Ludwigshafen-on-Rhine and the costs involved with these air pollution control techniques are discussed. (LCL)

**22094 Process for separation and recovery of carbon monoxide.** Johnson, M.M.; Tabler, D.C. (to Phillips Petroleum Co.). US Patent 4,042,669. 16 Aug 1977. Filed date 1 Oct 1975. 10p.

A process for the separation of carbon monoxide from mixed gases is described. The mixed gases are contacted with an absorbent system consisting essentially of an inert diluent and a copper (I) salt of a sulfonic acid or of a dialkyl phosphate.

**22095 Air pollution cleaning needs varied approach.** Stroem, H. *Processing;* **23**: No. 5, 26-27(May 1977).

In order to reduce air pollution and keep it at a 1970 level, it is estimated that the investment in the U.S. required for air pollution equipment will average $3 billion/yr to year 2000. Types of air pollution control equipment, i.e., dust collectors, bag filters, off-gas combustors, scrubbers, activated carbon filters, for controlling dusts, gases, and odor are discussed and their operating costs compared. (LCL)

# PARTICLE ACCELERATORS

## DESIGN, DEVELOPMENT, AND OPERATION

*REFER ALSO TO CITATION(S) 22639*

**22096 (LA—7023-PR) Intense neutron source facility. Progress report, July 1—September 30, 1977.** Brown, M.C. (comp.). (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1977. Contract W-7405-ENG-36. 35p. Dep. NTIS, PC A03/MF A01.

The beam interaction on the jet target at the Beam-on-Target (B-O-T) prototype was tested. The beam of hydrogen ions ranged in current from 9 to 15 mA and in energy from 90 to 105 keV. Nitrogen gas at 20°C was used for the jet target with an initial pressure of 12,400 kPa. At the highest plenum pressures used, the leakage rate from the jet into the first differential pumping stage remained unchanged with increasing current, indicating that much higher (greater than 0.25) f factors can be used before the jet performance is adversely affected. During the tests, static pressures along the target wall and the pressure in the first pumping stage were measured. Certain modifications were made to the B-O-T accelerator to increase the current density from initial turn-on value of 6 μA to an intensity of approximately 50 mA. Steady operation of the B-O-T is now being performed. The highest measured ratio for the desired ion-beam species has surpassed our minimum design goal of 65 percent. The U.S. Department of Energy's release of construction funds for the Intense Neutron Source (INS) facility continues to be a problem; however, 100 percent Title I review has been completed, and negotiations for Title II are under way. After careful consideration, it is planned to build the two $10^{15}$ n/s sources as originally proposed, with one operated as a "pure" 14-MeV neutron generator and the other surrounded by a multiplying fission converter to create a fusion-like neutron spectrum at approximately $10^{16}$ n/s. This latter source may be tripled at a later date.

**22097 (NCRP—51) Radiation protection design guidelines for 0.1 to 100 MeV particle accelerator facilities.** (National Council on Radiation Protection and Measurements, Washington, D.C. (USA)). 1 Mar 1977. 166p. Council on Radiation Protection Measurements, Washington, DC.

A report is given to provide design guidelines for radiation protection in particle-accelerator facilities, and to describe one or more methods by which this protection may be achieved. The recommendations may well be modified in unusual circumstances upon the professional advice of experts with recognized competence in radiation protection for particle accelerators. The report is concerned with accelerators producing particles having energies below 100 MeV, with exceptions and qualifications as itemized below: a. X-ray generators: All x-ray generators above 0.1 MV are considered to be within the scope. However, NCRP Report No. 49 (NCRP, 1976) is concerned with medical x-ray protection for energies up to 10 MeV. Structural shielding recommendations and x-ray transmission data given in NCRP Report No. 49 are applicable as well to non-medical applications of low-energy x-ray generators, particularly for energies below 0.5 MeV. The report given includes x-ray transmission data and shielding-calculation bases for these very low energies, but is primarily concerned with x-ray generators with accelerated electron energies above 0.5 MeV. b. Neutron generators: All particle accelerators that can produce neutrons are considered to be within the scope of this report. However, a forthcoming NCRP Report (NCRP, 1977) is concerned with protection for small neutron generators, i.e., deuteron accelerators below 0.4 MeV in particle energy. The present report is therefore primarily concerned with neutron-producing accelerators that accelerate charged particles to energies above 0.4 MeV. c. Electron accelerators: All electron accelerators with externally applied beams as low as 0.1 MeV in particle energy are included, whether used in medical or non-medical application.

**22098 Constant radius magnetic acceleration of a strong non-neutral proton ring.** Sprangle, P.; Kapetanakos, C. (Naval Research Laboratory, Washington, D.C. 20375). *J. Appl. Phys.;* **49**: No. 1, 1-6(Jan 1978).

The constrained or constant radius magnetic acceleration of a strong non-neutral proton ring by a modified betatron field is considered. The modified betatron field consists of an azimuthal magnetic field B/sub theta/superimposed on a betatron field B/sub z/ in which the 1 : 2 flux rule is satisfied. An important advantage of the constrained acceleration is that the energy of the nonrelativistic ions increases with the square of the magnetic field. It has been found that the orbits of the gyrating particles are stable when the self-field index n/sub s/{=$\omega^2$/sub p/[2γ/sub 0theta( t)/$\Omega^2_0$(t)]$^{-1}$} is much greater than unity, provided that n/sub s/< (B/sub theta /2Bz-italic/)$^2$ at the orbit. For B/sub theta/the orbits are stable only if n/sub s/<1/2.

**22099 Heavy-ion accelerators.** Grunder, H.A.; Selph, F.B. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Annu. Rev. Nucl. Sci.;* **27**: 353-392(Dec 1977).

Various types of heavy-ion accelerators, such as several cyclotrons and synchrotrous, are discussed in detail with regard to their applications, properties, and components.

**22100 (UCRL-Trans—1542) B-5 proton-ion synchrotron.** Abdul'manov, V.G.; Averbukh, I.I.; Auslender, V.L. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). Oct 1977. Translation of USSR report. (CONF-770709—16). 9p. NTIS, MF A01.

From 10. international conference on high energy accelerators; Serpukhov, USSR (11 Jul 1977).

Portions of document are illegible.

The B-5 proton-ion synchrotron is designed for producing accelerated proton beams up to an energy of 200 MeV and multiply charged ion beams to an energy of 50 MeV/nucleon. The use of a synchrotron as the accelerator makes it possible to accelerate quite a broad set of ions, to regulate their energy smoothly, and to have high extraction efficiency. The monochromaticity of the extracted beam is at least 1% for an extracted current pulse length up to 20 μsec at a pulse repetition frequency of 50 Hz. The intensity of the extracted beam is up to $10^{11}$ particles/sec.

**22101 High-current, high pulse rate electron accelerator with inductive energy storage.** Mikhailov, V.I.; Slivkov, I.N. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 703-705(Jun 1977).

The characteristics of a high-current, high-voltage electron accelerator with inductive energy storage and the associated electron-optical system used for electron acceleration and current switching in a storage device are discussed. Accelerators of this kind can be efficient and relatively simple and provide pulse repetition frequencies above 100—200 Hz and at an average power of tens or hundreds of kilowatts.

**22102 High voltage particle accelerator utilizing polycrystalline ferroelectric ceramic material.** Brody, P.S. US Patent 4,004,175. 18 Jan 1977. Filed date 9 Dec 1975. 5p.

The patent describes an apparatus which utilizes the high voltage generated by the impingement of illumination upon a polarized polycrystalline ferroelectric ceramic material as the source of a high voltage electric field through which charged particles are accelerated. The application of such device to a dc particle accelerator with capabilities similar to accelerators of the Van de Graaff type is shown, a uniform dc electric field being provided not through linking resistors as is the case in the Van de Graaff machine, but rather directly through the intrinsic properties of the ferroelectric ceramic material, the uniformity and magnitude of such field being further improved in at least one preferred embodiment through the utilization of parallel spaced-apart electrodes disposed through the ferroelectric ceramic material and terminating in hoops or other electrodes creating equipotential planes through which a beam of charged particles is accelerated.

## BEAM DYNAMICS, FIELD CALCULATIONS, AND ION OPTICS

**22103** (LA—6919) **LAMPF 201.25-MHz linac field distribution.** Jameson, R.A.; Halbig, J.K. (Los Alamos Scientific Lab., N.Mex. (USA)). Jan 1978. Contract W-7405-ENG-36. 20p. Dep. NTIS, PC A02/MF A01.

Returning of the 201.25-MHz accelerator structure field distributions after the 1975 shutdown is described, and final data are given for use in beam dynamics studies. Several improvements made in procedures included a different method for stopband closure check and a positive method for postcoupler clamping. To obtain accurate results for the first tank a rigorous data reduction technique that included the removal of a "signature" due to the bead-pull string itself was used. Other special studies are reported, including the effects of vacuum, bead size, slug tuners, and a bead-pull method for measuring the cavity quality factor Q.

**22104 Beam depolarization in the magnetic field of a synchrotron.** Didenko, A.N.; Esina, Z.N.; Kuznetsov, V.M. (Scientific-Research Institute of Nuclear Physics, Electronics and Automation, S. M. Kirov Polytechnical Institute, Tomsk). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 5, 614-616(May 1977).

The effect of betatron and synchrotron oscillations on the motion of the particle spin in the magnetic field of a synchrotron is studied. The first-approximation width of the spin resonances in the unperturbed and perturbed magnetic fields is given. A numerical calculation yields an estimate of the degree of beam depolarization after the main resonances are crossed during acceleration.

**22105** (UCRL-Trans—1541) **Synchrotron acceleration of variable charge heavy ions.** Shukeylo, I.A. 1977. Translation of Preprint B-0309, NIIEFA, Leningrad. 76p. Dep. NTIS, PC A05/MF A01.

The transverse focusing and phase stability of the heavy ions different charge states are considered. The storage injection mode based on charge exchange was studied, which provides for increasing the phase beam density. The acceleration of ions, the charge states of which being gradually increased during acceleration, is investigated.

**22106** (LA-tr—77-89) **Increase of the beam radius and particle oscillations due to errors in proton linear accelerators.** Vlasov, A.D. Translated by A.D. Cernicek from *Tr. Radiotekh. Inst.;* No. 16, 162-174(1975). 17p. MF A01.

Portions of document are illegible.

The beam radius increase in proton linacs due to all possible types of random errors both parametric and coherent is considered. The beam radius increase is determined as the increase of transverse particle oscillations of individual particles. The initial difference equation is constructed and it is shown that its solution is the sum of the two terms caused by parametric and coherent errors. For the case of relatively small coherent errors the approximate analytical expressions are obtained for both the average and confidence level increase of the beam radius. Numerical examples are given.

## AUXILIARIES AND COMPONENTS

**22107 Superconductor and cryogenic elements in a collective accelerator. I.** Ageev, A.I.; Anishchenko, N.G.; Balalykin, N.I.; Balandikov, N.I.; Beketov, V.V.; Belushkina, A.A.; Bychkov, N.S.; Volkovyskii, E.V.; Volkov, V.Y.; Danilov, V.V.; Zhitnikov, B.Z.; Zel'dovich, A.G.; Zel'dovich, N.K.; Zinov'eva, L.L.; Katrasev, V.V.; Krylov, V.V.; Lachinov, V.M.; Lur'e, S.I.; Matveev, E.V.; Menke, K.; Muratov, Y.V.; Rubin, N.B.; Sarantsev, V.P.; Smirnov, Y.I.; Tsvineva, G.P.; Shavratov, V.G.; Shishov, Y.A. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 696-701(Jun 1977).

The reasons underlying the choice of the superconductor elements (resonators and solenoids) of the accelerating section of a collective accelerator are given. These elements are described. Certain aspects of the system used for cooling are discussed. Information is given on the required magnetic field configuration and the magnetometer system.

**22108 Results of experiments on the rf superconducting accelerating section of the collective accelerator. II.** Ageev, A.I.; Anishchenko, N.G.; Balalykin, N.I.; Beketov, V.V.; Bychkov, N.S.; Bolkovyskii, E.V.; Zel'dovich, A.G.; Krylov, V.V.; Lachinov, V.M.; Muratov, Y.V.; Rubin, N.B.; Sarantsev, V.P.; Smirnov, Y.I.; Treibalova, Z.V.; Shabratov, V.G.; Shishov, Y.A. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 701-702(Jun 1977).

We describe experiments carried out to measure the Q of niobium—titanium superconducting resonators used in the accelerating section of the collective accelerator; the magnetic field produced by the superconducting solenoids and the characteristics of the superconducting wire are also described. Data on the heat influx to the various parts of the section and the energy-removal process are also reported.

**22109 Neutrino beam of the Institute of High-Energy Physics. III. System for shaping the proton beam for the external target.** Baratov, D.G.; Zaitsev, M.M.; Kotov, V.I.; Maisheev, V.A.; Rzaev, R.A.; Rykov, V.L.; Samoilov, A.V.; Sapunov, Y.M.; Sakharov, V.P.; Frolov, A.M. (Institute of High-Energy Physics, Protvino). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 5, 601-604(May 1977).

The magnetic-optics channel which shapes the extracted 70-GeV proton beam of the accelerator of the Institute of High-Energy Physics for neutrino experiments is described. The tolerances on the adjustment and the stability of the electrical power supplies for the magnetic elements of the channel, the influence of the field harmonics on the beam, and the procedure for adjusting the channel as a whole are briefly described. Experimental results are reported.

**22110 Neutrino beam of the Institute of High-Energy Physics. IV. Focusing device of the neutrino channel.** Baratov, D.G.; Bikbulatov, N.Z.; Vasil'ev, V.V.; Gubrienko, K.I.; Knyazev, S.A.; Lastochkin, Y.A.; Oshchenkov, V.P.; Rzaev, R.A.; Rykov, V.L.; Samoilov, A.V.; Chernov, V.A.; Shalashov, I.M. (Institute of High-Energy Physics, Protvino). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 5, 605-611(May 1977).

The system for producing the neutrino beam at the accelerator of the Institute of High-Energy Physics is described. The basic characteristics and structural features of the neutrino focusing device are described. This device consists of three objectives made of parabolic lenses. Current pulses up to 0.5 mA with a length of 160 μsec pass through the lenses. Data on the operation of the focusing device are reported. The ratio of the muon fluxes in the shielding in the cases with and without focusing ranges from 4 to 30, depending on the momentum. This ratio is a measure of the operation of the neutrino focusing device.

**22111** (LA-tr—77-70) **Proposal for an experiment at SIN: dosimetry of the πE3 beam: determination of the beam components.** Appel, H.; Boehmer, V.; Bueche, B.; Galstar, S.; Kluge, W.; Matthaey, H. (Karlsruhe Univ. (TH) (Germany, F.R.). Inst. fuer Experimentelle Kernphysik). 1977. Translation of A-74-03.0. 6p. Dep. NTIS, PC A02/MF A01.

The ratios of pions, muons and electrons for beam πE3 are to be determined. These components consist of particles of equal momentum which traverse the beam control system—such as muons, which are produced along the flight path by the decay of pions. Knowledge of the ratio of particles is particularly important when test results from biological experiments—obtained with different accelerators or with different beam settings—are to be compared. The ratios of the components depend on the specific beam settings (accepted impulse band, beam profile). The measuring technique selected is the time-of-flight method, whereby the beam path from target E is used as the path distance. In addition, the specific energy losses of the particles is measured to identify the muons resulting from the decay of pions.

**22112** (LA-tr—77-93) **Fast accelerating field stabilization systems for the accelerator resonators of the meson factory.** Kvasha, A.I.;

Murin, B.P.; Semunkin, Yu.F. Translated by A.D. Cernicek from *Tr. Radiotekh. Inst.;* No. 20, 73-81(1974). 13p. MF A01.

Portions of document are illegible.

Fast phase and amplitude accelerating field stabilization systems are described for a resonator in the first stage of a linear accelerator. Conditions for the accelerating field invariance are obtained relative to perturbations produced by a beam which makes it possible to work out the requirements for final control elements of the systems. Simplified expressions are given for analysis of stability in the automatic control systems.

**22113** (LA-tr—77-40) **Systems of RF field stabilization and coherent-oscillation suppression in the linac first stage.** Guseva, K.I.; Kvasha, A.I.; Murin, B.P.; Semunkin, Iu.F.; Shchetinina, N.A. Translated by A.D. Cernicek from *Tr. Radiotekh. Inst.;* No. 16, 180-195(1973). 8p. MF A01.

Portions of document are illegible.

Rf field stabilization systems for the first stage of the meson factory linac and a system to suppress coherent oscillations in the transition between the first and the second parts of linac are described. The controlling devices of these systems are discussed. The functional diagrams and the results of preliminary calculations of control systems stability are presented.

### ION SOURCES

*REFER ALSO TO CITATION(S) 22099*

**22114** (LA—7077-T) **Investigation of multi-charged heavy ion production in an electron beam ion source.** Hamm, R.W. (Los Alamos Scientific Lab., N.Mex. (USA)). Dec 1977. Contract W-7405-ENG-36. 102p. Dep. NTIS, PC A06/MF A01.

Measurements of multi-charged heavy ions produced in an Electron Beam Ion Source (EBIS) were carried out with a test model ion source 20 cm in length. This test model utilized an electron gun placed external to the bore of the focusing solenoid in order to achieve electrostatically focussed electron beams and isolation of the vacuum surrounding the electron gun from the vacuum in the ionization region within the solenoid bore. An ultrahigh vacuum system utilizing liquid nitrogen (77°K) cryopumping was used to achieve the low pressures needed in the ionization region for the operation of this ion source. Several technical problems limited the operation of this test model and prevented a thorough investigation of the ionization processes in the ion source, but the experimental results have shown qualitative agreement with the theoretical calculations for the operation of this type of ion source. Even with the problems of an insufficient vacuum and electron beam focussing field, measurable currents of $C^{+5}$ and $A^{+8}$ ions were produced. The present experimental results suggest that the approach taken in this work of using an external electron gun and cryopumping in the EBIS to achieve the large electron beam current density and low vacuum necessary for successful operation is a viable one. Such an ion source can be used to create highly-charged heavy ions for injection into a cyclotron or other type of particle accelerator.

**22115** **Magnetron discharge as a source of H-ions.** Prelec, K.; Shternberg, Z. (Brookhaven National Lab., Upton, N.Y. (USA); Institut Rudjer Boskovic, Zagreb (Yugoslavia)). *Fiziol. Rast.;* 9: No. 1, 37-53(1977).

The energy distribution of fast hydrogen atoms formed by neutralization of positive ions and subsequent backscattering at the magnetron cathode is derived from the contours of Balmer lines emitted in the direction parallel to the electric field. The effects of inelastic collisions in the discharge on the distribution function thus obtained are considered. The effective yield of H- per backscattered H atom, $\alpha^-$, is estimated from the calculated coefficients of secondary emission and from the energy distribution of atoms backscattered at the cathode; $\alpha^-$ is found to be approximately equal to 0.5 for a cesiated molybdenum surface. It is shown that the attenuation of the flux of fast $H^-$ ions generated at the magnetron cathode is mainly due to slowing down of Hsup(-) by charge exchange and destruction of slow Hsup(-) by charge transfer and collisional detachment in the positive column. The thermal regime of magnetron cathodes and the rate of desorption of chemisorbed cesium are considered and a scaling law is derived which relates thermal load, discharge pulse duration and increase of cathode surface temperature.

### INJECTION AND EXTRACTION SYSTEMS

**22116** **Neutrino beam of the Institute of High-Energy Physics. I. General description and basic characteristics.** Baratov, D.G.; Bugorskii, A.P.; Vovenko, A.S.; Gubrienko, K.I.; Eremenko, E.V.; Komarov, V.V.; Kotov, V.I.; Krendelev, V.A.; Krupnyi, G.I.; Kurnaev, O.V.; Lebedev, V.N.; Moizhes, L.L.; Mukhin, A.I.; Myznikov, K.P.; Rastsvetalov, Y.N.; Rzaev, R.A.; Samoilov, A.V.; Sulyaev, R.M.; Tatarenko, V.M.; Tushabramishvili, K.Z.; Kholodenko, M.A. (Institute of High-Energy Physics, Protvino). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* 22: No. 5, 591-595(May 1977).

The neutrino channel of the accelerator of the Institute of High-Energy Physics is described. The general characteristics of the systems for producing the neutrino beam and the properties of the neutrino and antineutrino beams are described. This paper is an introduction to a series of papers on this neutrino channel.

**22117** **Neutrino beam of the Institute of High-Energy Physics. II. Characteristics of the 70-GeV proton beam extracted for neutrino experiments.** Afonin, A.G.; Drozhdin, A.I.; Dogotar', A.A.; Zelenov, B.A.; Komarov, V.V.; Kurnaev, O.V.; Levin, A.V.; Merker, E.A.; Moizhes, L.L.; Myznikov, K.P.; Roshchin, A.A.; Tarakanov, N.M.; Tatarenko, V.M.; Kholodenko, M.A. (Institute of High-Energy Physics, Protvino). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* 22: No. 5, 595-601(May 1977).

Adjustment of the system for transporting the extracted proton beam from the accelerator of the Institute of High-Energy Physics for neutrino experiments is reported. The system for fast extraction and transport of the beam is described. The technical characteristics of the magnetic elements of the channel and their power supplies are reported. The transport system, the nominal parameters, the tolerances, and the characteristics of the apparatus are described. The instruments used for beam diagnostics are described. The adjustment of this system and the experimental characteristics of the extracted proton beam are reported.

### EXPERIMENTAL FACILITIES AND EQUIPMENT

**22118** (LA—7034-MS) **Data analysis facility at LAMPF.** Perry, D.G.; Amann, J.F.; Butler, H.S.; Hoffman, C.J.; Mischke, R.E.; Shera, E.B.; Thiessen, H.A. (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1977. Contract W-7405-ENG-36. 15p. Dep. NTIS, PC A02/MF A01.

This report documents the discussions and conclusions of a study held in July 1977 to develop the requirements for a data analysis facility to support the experimental program in medium-energy physics at the Clinton P. Anderson Meson Physics Facility (LAMPF). 2 tables.

**22119** (ORO—2504-267) **Proposed neutron bottle for the Argonne pulsed neutron source and its application in the search for the neutron electric dipole moment.** Dombeck, T.W. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Nov 1977. Contract EY-76-C-05-2504. 71p. Dep. NTIS, PC A04/MF A01.

The importance of knowledge of a neutron electric dipole moment (EDM) is pointed out, and it is suggested that use of ultracold stored neutrons would be a good method to improve the upper limit on this quantity greatly. This report presents a conceptual design for such a facility to be used in conjunction with the ANL pulsed neutron source. The source and details on the neutron bottle design are discussed; it is concluded that building the facility proposed is feasible. General considerations, apparatus and method, and systematic effects limiting the EDM measurement are considered. 12 figures, 8 tables. (RWR)

## STORAGE RINGS

**22120** (BNL—23493) **Tables of particle fluxes.** Willen, E.H. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 7p. (CONF-770753—2). Dep. NTIS, PC A02/MF A01.

From Isabelle workshop; Upton, NY, USA (18 Jul 1977).

The formula of F. Paige for secondary particle fluxes expected at ISABELLE has for convenience been tabulated over a range of momenta. The data are presented as flux/sec in 1 cm sq. areas. areas at various x, y positions (x = y = 0 is the intersection point) in a plane perpendicular to one of the colliding beams and located 1 meter from their intersection. The 1 cm sq. areas are taken as planes perpendicular to a vector connecting the area to the intersection point. Relevant parameters for each table are listed at the top of the table.

# INSTRUMENTATION

*REFER ALSO TO CITATION(S) 21469*

## RADIATION INSTRUMENTATION

### GENERAL DETECTORS AND MONITORS

*REFER ALSO TO CITATION(S) 21128, 22163, 22164, 22165, 22166, 22167, 22168, 22169, 22170, 22171, 22172, 22173, 22174, 22175, 22176, 22177, 22178, 22180, 22182, 22188, 22189, 22200, 22202, 22293, 22294, 22641*

**22121** (ORNL-tr—4529) **Activation detectors for recording pulsed fluxes of fast neutrons.** Dyatlov, V.D.; Kunayev, G.T.; Popytayev, A.N.; Cheremukhov, B.V. 1977. Translation of Preprint K-0336, NIIEFA, Leningrad, 1977, pp 1-20. 21p. Dep. NTIS, PC A02/MF A01.

The requirements to the activation detectors of the pulsed flows of the fast neutrons are considered; the criteria of optimum measurement time, geometrical moderator sizes and radioactive indicator properties have been obtained. On their analysis parameter selection has been carried out. The neutron detector to register the short pulses has been designed and calibrated. The ways of further increase of sensitivity and efficiency of such detectors are being discussed.

**22122** **Real-time alpha-beta-gamma environmental radiation monitoring system.** Battist, L.; Keene, W.; Schadt, W.; Thiess, P. (Catholic Univ. of America, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 133-135(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22123** **Field procedure for quantitative assessment of gamma cameras.** Lewellen, T.K.; Williams, D.L.; Murano, R. (Univ. of Washington, Seattle). *Trans. Am. Nucl. Soc.;* **27**: 167(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22124** **Noise in 3-D imaging with large-area positron cameras.** Macdonald, B.; Lenahan, J.P.; Perez-Mendez, V. (Univ. of California, Berkeley). *Trans. Am. Nucl. Soc.;* **27**: 168-169(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22125** **Background effects in scintillation counter telescopes in the upper atmosphere.** Matteson, J.L. (Univ. of California, San Diego). *Trans. Am. Nucl. Soc.;* **27**: 199-200(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### NUCLEAR SPECTROSCOPIC INSTRUMENTATION

*REFER ALSO TO CITATION(S) 22293, 22648*

### HIGH ENERGY PHYSICS INSTRUMENTATION

**22126** **Hybrid bubble chamber systems.** Ballam, J.; Watt, R.D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Annu. Rev. Nucl. Sci.;* **27**: 75-138(Dec 1977).

The uses, characteristics, and performances of hybrid bubble chamber systems are reviewed. The SLAC and CERN systems are discussed in some detail.(AIP)

### RADIOMETRIC INSTRUMENTS

**22127** **Control system design using radioactive pickoff.** Friedland, B.; Richman, J. (Singer Co., Little Falls, NJ). pp 422-427 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

An accelerometer can be constructed using a radioactive proof mass the position of which can be determined on the basis of the difference between the mean number of emitted charged particles detected at opposite walls when the proof mass is not centered. If the emission rate is relatively small, however, the mean counting rate is very noisy; satisfactory operation requires optimum signal processing. The control system, designed by linear stochastic control theory, generates forces that tend to keep the proof mass centered between walls of the instrument and simultaneously produces an estimated acceleration output. The Poisson-type noise of the pickoff is approximated by Gaussian noise; the acceleration input is modeled as a random walk. It is found by simulation that for an instrument with 1.0 inch spacing between the walls, the proof mass excursion can be confined to a peak-to-peak amplitude of 0.36 inch in a severe acceleration environment. The accelerometer output tracks a constant input without error and, when the input acceleration has a random component, the rms error is of the order of ten percent of the random component.

## RADIATION EFFECTS ON INSTRUMENT COMPONENTS, INSTRUMENTS, OR ELECTRONIC SYSTEMS

**22128** **RTG radiation and its effect on spacecraft instrumentation.** Campbell, R.W.; Noon, E.L.; Truscello, V.C. (Jet Propulsion Lab., Pasadena, CA). *Trans. Am. Nucl. Soc.;* **27**: 201-202(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## MISCELLANEOUS INSTRUMENTS

*REFER ALSO TO CITATION(S) 20857, 20862, 21101, 21577, 21579*

**22129** (SAND—77-1914C) **Data aquisition and processing system.** Isidoro, R.J. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 20p. (CONF-771206—23). MF A01.

From Digital signal processing symposium; Albuquerque, NM, USA (6 Dec 1977).

Portions of document are illegible.

In testing complex bomb and warhead subsystems, the interdependence between channels in a multichannel test makes test performance analysis difficult. In the past, oscillogram techniques were used to record and analyze such data; but their inherent inaccuracies, their potential for human error, and the large amount of time they consume have limited their effectiveness. As an alternative to oscillogram methods, Sandia Quality Assurance uses an analysis technique that utilizes a general-purpose digital computer system, implemented by Scientific Data System, Inc. The basis of the system is an SDS92 digital computer, with 32K twelve-bit words of core storage, console typewriter, papertape reader and punch, two magnetic tape units, line printer, and card reader. The system acquires up to 100 channels of real-time analog data from any of several laboratory system testers, processes and records the data, and performs comprehensive analyses. Matching between the tester and recording equipment is provided by amplifiers within the system. Test information is continuously digitized and recorded on magnetic tape at a rate of 15K to 120K nine-bit samples per second. The system produces accurate analysis results within 30 minutes from the completion of a typical test. 10 figures.

**22130** **Measurement of the Stokes parameters of light.** Berry, H.G.; Gabrielse, G.; Livingston, A.E. (University of Chicago, Physics Department, Chicago, Illinois 60637). *Appl. Opt.;* **16**: No. 12, 3200-3205(Dec 1977).

We describe a measuring system for determing the state of polarization of a beam of light in terms of its Stokes parameters. The technique which can be fully automated incorporates a monochromator and single photon counting detection and can thus be applied over a large wavelength range for very weak optical signals. Fourier transformation of the data by an on-line minicomputer allows immediate calculation of the Stokes parameters. We discuss special applications to light emitted from excited atomic systems with and without cylindrical symmetry.

**22131** **Portable low-dose x-ray imaging system.** Yin, L.I. (NASA, Greenbelt, MD); Seltzer, S.M.; Trombka, J.I. *Trans. Am. Nucl. Soc.;* **27**: 167-168(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

# EXPLOSIONS AND EXPLOSIVES

## CHEMICAL

**22132** (M—078-02) **Quality assurance plan. Site 300 chemistry high explosives facilities.** (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1977. Contract W-7405-ENG-48. 9p. Dep. NTIS, PC A02/MF A01.

The purpose of this plan is to minimize the risk to the safety and health of personnel, to reduce potential monetary losses, to preserve the equipment and facilities, to control product quality, and to maintain the continuity of operations at the Chemistry High Explosives (HE) Facilities at Site 300.

**22133** (MHSMP—77-57) **Summary of chlorine free synthesis of TATB. Process Development Endeavor No. 106.** Estes, Z. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Oct 1977. Contract EY-76-C-04-0487. 5p. Dep. NTIS, PC A02/MF A01.

A summary of the Mason and Hanger efforts to synthesize s-triaminotrinitrobenzene (TATB) which is free from inorganic chlorides and other detrimental impurities is presented.

**22134** (MHSMP—77-58) **Mechanical properties of LX-10-1. Process Development Endeavor No. 105.** Johnson, H.D. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Oct 1977. Contract EY-76-C-04-0487. 11p. Dep. NTIS, PC A02/MF A01.

Two Holston lots of LX-10-1 were evaluated for mechanical properties. The average 21°C tensile failure stress-strain values for Lot 711-1 and 711-2 were 2.32 MPa at 0.15% and 2.07 MPa at 0.18%, respectively. The failure stress range for both lots was approximately 0.4 MPa at 74 C to 5.6 MPa at -37C. Several additional pressing cycles were required to obtain a density of 1.865 $Mg/m^3$ for Lot 711-1 material. The additional cycles appear to have increased the tensile failure stress of Lot 711-1 slightly.

**22135** **Thermochemistry of explosives: a review.** Collins, L.W.; Haws, L.D. (Monsanto Research Corp., Miamisburg, OH). *Thermochim. Acta;* **21**: No. 1, 1-38(Oct 1977).

The application of traditional thermal analysis techniques as well as specialized thermal techniques to the characterization of explosives is reviewed. Topics included are general references, pressure measurement techniques, gaseous product analysis, DTA, DSC, TG, combined TG—DTA, and miscellaneous techniques as applied to a variety of explosive materials. The bibliography includes 135 references.

**22136** **Thermal ignition time for homogeneous explosives involving two parallel reactions.** Nunziato, J.W.; Kennedy, J.E.; Amos, D.E. (Sandia Lab, Albuquerque, NM). *Combust. Flame;* **29**: No. 3, 265-268(1977).

An expression is derived for the thermal ignition time of a homogeneous explosive which is exothermically decomposing by two parallel Arrhenius reactions. The result involves the thermal ignition time of each reaction alone, and is expressed in terms of the hypergeometric function. Application of this analysis to the case of nitromethane ignition is illustrated. 8 refs.

## NUCLEAR

*REFER ALSO TO CITATION(S) 22220*

### CIVIL USES

**22137** (LA-tr—77-65) **Effect of detonation depth on the action of underground explosions in rock.** Ginsburg, T. Translated by T.L. Cook from *Explosivstoffe;* **14**: 126-132, 154-158, 169-174(1966). 38p. Dep. NTIS, PC A03/MF A01.

The effects of detonation depth of nuclear explosions on crater formation, radioactive fallout, prompt radiation, air shock, air-induced ground shock, direct ground shock, and electromagnetic impulse are examined. (TFD)

### WEAPONRY

*REFER ALSO TO CITATION(S) 22129*

**22138** (BDX—613-1945) **Digital RLC analysis of CDU fireset x-units.** Bennett, A.G. (Bendix Corp., Kansas City, Mo. (USA)). 1977. Contract EY-76-C-04-0613. 30p. Dep. NTIS, PC A03/MF A01.

An accurate and repeatable technique has been developed for quantitatively determining the dynamic resistance, inductance, and capacitance (RLC) of CDU Fireset X-units by digital analysis of the output current waveform. The waveform is digitized with 8 bit resolution at a 10 ns sample rate. A calibration file provides correction for attenuator and digitizer errors. Data accuracy is optimized by software filtering to minimize the digitizing noise component. R, L, and C are derived by selecting any four waveform coordinates as limits for a series of multiple numerical integrations. The integrals become coefficients for a system of linear equations which are solved simultaneously to obtain the circuit impedance. The approach is independent of circuit damping, eliminates the need for determining the waveform starting point, and is accurate to 1 percent in the presence of noise. The technique has been successfully employed at Bendix to identify defects and variations in components and processes used in the manufacture of X-unit assemblies.

**22139** (CONF-771055—1) **U.S. nonproliferation policy and the reactions of the technical community.** Feldman, M.J. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 9p. Dep. NTIS, PC A02/MF A01.

From Congress of international technology; Pittsburgh, PA, USA (9 Oct 1977).

The U.S. policy on nonproliferation of nuclear weapons is briefly outlined. Seven basic reactions to the policy from the technical community are presented. (TFD)

**22140** (SAND—77-8040) **Hybrid trajectory simulation of the B77 system.** Bolton, W.R. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0789. 50p. Dep. NTIS, PC A03/MF A01.

General equations of motion are developed and then specialized to form the basis of a B77 two-stage parachute system simulation. In this simulation, the body/parachute system is treated as a single composite body with six degrees of freedom and the parachute is allowed only three rotational degrees of freedom relative to the body. A general description of the hybrid computer implementation of this simulation is provided.

# ENVIRONMENTAL SCIENCES, ATMOSPHERIC

*REFER ALSO TO CITATION(S) 21469*

## BASIC STUDIES

*REFER ALSO TO CITATION(S) 22191*

**22141** (PNL—2433) **Hanford 67-series: a volume of atmospheric field diffusion measurements.** Nickola, P.W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1977. Contract EY-76-C-06-1830. 466p. Dep. NTIS, PC A20/MF A01.

This volume documents atmospheric diffusion experiments carried out at the Hanford reservation during the period 1967 to 1973. A total of 103 tracer releases during 54 release periods is tabulated. Multi-tracer releases (generally from different elevations) were made during most of the experimental periods. Release heights varied from ground level to an elevation of 111 m. Tracers were sampled simultaneously on as many as 10 arcs at distances of up to 12.8 km from the tracer release point. As many as 718 field sampling locations were employed during some of the experiments. Vertical profiles of concentration were monitored on towers during 23 of the 54 release periods. Concurrent vertical profiles of mean temperature, of mean wind speed and direction, and of direction standard deviation are also tabled for elevations up to 122 m.

**22142** **Application of parameter estimation and hypothesis test for a generalized gamma distribution.** Nicholson, D.L. (Naval Academy, Annapolis). pp 321-326 of In Proceedings of the 1975 IEEE conference on decision and control. Piscataway, NJ; IEEE, Inc. (1975).

From 14. IEEE decision and control conference on adaptive processes; Houston, TX, USA (10 Dec 1975).

See CONF-751266—.

Maximum likelihood (ML) estimation procedures are developed for the parameters of a generalized Gamma probability density function. In addition, the likelihood ratio conditioned on the ML estimates of the process parameters is given. A special case arising in the analysis of carbon monoxide pollution data is discussed in detail and the performance of the binary hypothesis test functioning as a pollution forecasting algorithm is reported.

### RADIOMETRIC TECHNIQUES

*REFER ALSO TO CITATION(S) 22200*

**22143** (EML—334, pp I.15-I.36) **Analyses of quality control samples at EML and a contractor laboratory during 1977.** Hardy, E.P. 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

Sets of biological and fallout samples analyzed at EML and by a contractor laboratory include quality control samples which are submitted as blinds. These checks consist of blanks, reference samples analyzed repeatedly over a period of years, replicates or splits of unknowns, spikes, and duplicate samplings. This report summarizes quality control data for ashed bone, various ashed foods, tap water, and fallout samples analyzed for Sr-90, Cs-137 and Ca during 1977.

## CHEMICALS MONITORING AND TRANSPORT

*REFER ALSO TO CITATION(S) 20905, 20935, 21999, 22152, 22154, 22159, 22196, 22205, 22221, 22276*

**22144** (DOE/PE—0001) **1985 air pollution emissions.** Pechan, E.H. (Department of Energy, Washington, D.C. (USA)). Dec 1977. 152p. Dep. NTIS, PC A08/MF A01.

Emissions were analyzed from point and area sources for each of the 243 Air Quality Control Regions in the United States using a computer-assisted analytic procedure. Point sources primarily consist of industrial and utility fuel combustion, industrial process emissions, and other large sources while area sources primarily consist of transportation sources (mainly automobiles) and small fuel combustion sources. Five criteria pollutants were anlyzed in detail: total suspended particulates, sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide. In addition, a preliminary estimate was made of discharges of selected toxic/hazardous pollutants to air for the nation from industrial and utility boilers. Results indicate that the primary difference between environmental emissions of initiative and nominal provisions is a change in the distribution rather than in absolute values. Also, to the extent that the initiatie case will result in measurable increases in pollution discharges in some areas of the country, it will also result in decreases in other areas. Further work is needed to more accurately identify and characterize impacts on areas smaller than those considered for this study. It is indicated that aggregation of emissions to multi-state or national totals tends to obscure observation of differences between the various scenarios--differences which are likely to be most significant locally.

**22145** (PB—269559) **Hydrocarbon and oxidant chemistry observed at a site near St. Louis. Final report 30 June 1975—30 June 1976.** Rasmussen, R.A.; Chatfield, R.; Holdren, M. (Western Biological Labs., Culver City, Calif. (USA)). Jun 1977. Contract EPA-68-02-2254. 118p. NTIS PC A06/MF A01.

Integrated quantitative gas chromatographic measurements of the nearly one hundred individual hydrocarbons present in ambient air were made to determime the total non-methane organic burden at a midwest rural site in coordination with halocarbon, oxidant and local meteorological variables in July and August 1975. Although the sample location was clearly rural, it was only 100 km north of St. Louis, Missouri. Consequently, four situations could be distinguished at this site: clean rural air, transport from near urban areas, transport from distant urban areas, and air-mass stagnation. In the later situation, the rural air was well mixed on a regional scale with natural and anthropogenic ozone precursors. Fluorocarbon-11 and meteorological data were used to identify and describe the four situations and to interpret the observed concentrations of hydrocarbons and oxidant resulting from local photochemistry and transport.

**22146** (PB—269567) **Regional air pollution study. point source emission inventory. Final report.** Littman, F.E.; Griscom, R.W.; Klein, O. (Rockwell International Corp., Creve Couer, Mo. (USA). Air Monitoring Center). Mar 1977. Contract EPA-68-02-1081. 354p. NTIS PC A16/MF A01.

Emission data from stationary point sources in the St. Louis Interstate Air Quality Control Region were gathered during 1975. Data for 'criteria' pollutants were obtained on an hourly basis. Emissions from large sources were based on hourly, measured values at pertinent operating parameters. Those from smaller sources, between 10 and 1000 tons per year, were based on annual data modified by a detailed operating pattern. Examples of the data are presented in the report. The full set of data are available from the RAPS Data Bank. An emission factor verification program was initiated by testing typical sources using standard EPA methods. Results indicate good agreement for $SO_2$ values. Data for NOx and particulates originating from combustion sources indicate that the existing factors are too high by variable but substantial amounts.

**22147** (PB—269877) **Oxidant-precursor relationships during pollutant transport conditions. An outdoor smog chamber study. Final report May 1974—November 1975.** Ripperton, L.A.; Sickles, J.E. II; Eaton, W.C. (Research Triangle Inst., Research Triangle Park, N.C. (USA). Systems and Measurements Div.). Nov 1976. Contract EPA-68-02-1296. 223p. NTIS PC A10/MF A01.

The formation of ozone under simulated conditions of pollutant transport was studied in a group of four 27-cubic-meter outdoor smog chambers. The chambers were constructed of 5 mil FEP Teflon on aluminum frames. The initial charges in the smog chambers were irradiated for three days by natural sunlight. Simulation of transport was accomplished by progressively diluting the contents of the chambers with clean air. The analogy between the chemical behavior of chamber simulations and nonurban high-ozone (i.e., 0.08 ppm) systems in the field was good. On the second and third days, the initial charges in the chambers generated ozone concentrations greater than the National Ambient Air Quality Standard for photochemical oxidant (0.08 ppm). The initial charge of nonmethane hydrocarbon (NMHC) ranged from 1.0 to 10.0 ppmC; nitrogen oxides (NOx) ranged from 0.100 to 1.000 ppm. Therefore, initial ratos of NMHC/NOx varied from 7 to 20. On the second and third days in the chambers, concentrations of NOx ranged from 0.001 to 0.053 ppm; NMHC ranged from 0.33 to 3.78 ppmC. The resulting NMHC/NOx ratios varied from 16 to 610. This report was submitted in fulfillment of EPA contract 68-02-1296 (43U-994, RTI Contract Number) by the Research Triangle Institute under the sponsorship of the Environmental Protection Agency.

**22148** (SNV-PM—794) **Lead, expecially exhaust lead, in the terrestrial environment: accumulation and ecological effects. A literature survey.** Folkeson, L. (Lund Univ. (Sweden)). Dec 1976. 103p. (In Swedish). Dep. NTIS (US Sales Only), PC A06/MF A01.

Global emission of motor exhaust lead is 1/4 million metric tons/yr. The largest particles settle close to the road, but the smallest ones form aerosols and can be transported over whole continents. Data on the transport and toxicity of lead in terrestrial ecosystems are reviewed.

**22149** (TID—27836) **First annual report on weather modification effects of cooling towers.** Hanna, S.R.; Hosker, R.P. Jr. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.). Jul 1976. Contract EY-76-C-05-3688. 111p. Dep. NTIS, PC A06/MF A01.

A cooling tower plume and cloud growth model were developed. Using observed atmospheric vertical profiles of temperature, dew point and wind speed, and the source parameters for a cooling tower, the plume and cloud growth model estimates the variation with height of vertical speed, temperature, water vapor content, and liquid water content in the plume. The present model is one dimensional and steady state, but future plans call for the development of multidimensional models. The model predictions are compared to observations of cooling tower plumes at the Rancho Seco and John E. Amos power plants and a refinery cloud. Fair agreement is obtained between estimates and observations of excess water and temperature in the plume, visible plume length, and plume rise. The model is also applied to 241 radiosonde soundings from Nashville, using four hypothetical sources ranging from a single 1000 MW cooling tower to a $10^5$ MW power park. It is estimated that liquid water will form at the top of the plume 39% of the time for the 1000 MW tower. Estimated visible plume length and plume rise are presently being compared with observations from TVA's Paradise, Kentucky, cooling tower. The plans for laboratory study of flow and plume behavior near single and multiple cooling towers of different types are presented. An extensive survey of the laboratory simulation literature has been completed, requirements for the requisite modeling facility formulated, and equipment, including a suitable wind tunnel, purchased. Funding and construction delays in obtaining a building to house the tunnel have unavoidably postponed the start of the experimental test program.

**22150** **Sensitive optoacoustic detection of carbon monoxide by resonance absorption.** Gerlach, R.; Amer, N.M. (Physics Department, University of California, Berkeley, California 94720). *Appl. Phys. Lett.;* **32**: No. 4, 228-231(15 Feb 1978).

Sensitive (0.15 ppm) and unambiguous detection of carbon monoxide is reported and a comparison of acoustically resonant and nonresonant detectors is given. The pressure dependence of the optoacoustic signal is discussed in the context of atmospheric absorption.

**22151** **Application of a statistical trajectory model to the simulation of sulfur pollution over northeastern United States.** Sheih, C.M. (Argonne National Lab., IL). *Atmos. Environ.;* **11**: 173-178(1977).

A regional-scale model of atmospheric sulfur pollution is developed for the northeastern United States. The model approximates the long-term average plume from each pollutant source by a series of puffs in which the horizontal distribution of pollutant concentration is assumed to be Gaussian. To construct the puffs, a simulated tracer particle is released twice a day and its location is computed for every 3-h interval by use of observed wind velocities. The location of the center of each puff at certain times after the release is computed by averaging the coordinates of all the particles at the same time after the release, and the standard deviations of the coordinates of these particles with respect to the puff center are used to define the size of the puff. The vertical distribution of material in each puff is computed from a numerical integration of a system of two equations which describe the budgets of sulfur dioxide and

sulfate, with consideration of inversion height, surface deposition, effective stack height and chemical transformation. These four factors are varied in a series of sensitivity tests for the model. The final concentrations of sulfur dioxide and sulfate at a point of interest are obtained by summing the contributions of all the puffs to that point. In the present simulation, pollutant sources of sulfur dioxide originated from 53 major power plants in the northeastern United States are considered, and maps of predicted sulfur dioxide and sulfate concentrations at 2 m height and of the dry deposition of sulfur have been presented.

## RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

*REFER ALSO TO CITATION(S) 22122, 22143, 22200, 22205, 22265*

**22152** (EML—334) **Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.** Hardy, E.P. Jr. (Department of Energy, New York (USA). Environmental Measurements Lab.). 1 Jan 1978. 122p. NTIS, MF A01.

Portions of document are illegible.

Separate abstracts were prepared for eight sections of this report on environmental monitoring of fallout radionuclides and chemical effluents released by the combustion of fossil fuels. A list is included of 90 recent publications on environmental pollution.

**22153** (EML—334, pp I.3-I.14) **Updating stratospheric inventories to April 1977.** Leifer, R.; Toonkel, L. 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

The stratospheric inventories of Sr-90, Zr-95, Cs-137 and Pu-239, 240 are reported up to November 1976. The April 1977 stratospheric inventories for Zr-95 and Cs-137 are also included. The stratospheric burden of Sr-90 dropped to 10 kCi by November 1976. The ratios of the Cs-137 inventories to those of Sr-90 are close to the theoretical production value of 1.44. Based on the Zr-95 inventory for April 1977 it is estimated that the November 17, 1976 Chinese nuclear test injected 225 kCi of Sr-90 into the Northern Hemisphere stratosphere.

**22154** (EML—334, pp I.37-I.67) **EML Surface Air Sampling Program: the quality of analysis, 1976.** Toonkel, L.E.; Feely, H.W. 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

In general the quality of the analyses in the Surface Air Sampling Program in 1976 was satisfactory. The accuracy averaged within 10% and the mean precision was within +-10% in most cases. There was a continued negative bias for Zr-95 and Be-7, as well as a new negative bias for Cs-137 and Ce-144. Stable lead and Pb-210 results for the latter portion of the year showed poor chemical yields.

**22155** (EML—334, pp II.2-II.6) **EML fallout program data.** 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

Brief summaries are presented of programs to measure fallout $^{89}Sr$ and $^{90}Sr$ in samples of surface air and precipitation collected at 79 worldwide stations, radionuclides in samples from the lower stratosphere, $^{90}Sr$ in samples of milk and tap water collected in New York City, estimation of the annual dietary intake of $^{90}Sr$ by residents of New York City and San Francisco, and measurements of $^{90}Sr$ in samples of human bones collected in New York City and San Francisco. Results of measurements of the content of $^{90}Sr$ in foods purchased in New York City and San Francisco during the second quarter of 1977 are included.

**22156** (EML—334, pp II.7-II.67) **Project Airstream.** Leifer, R.; Toonkel, L. 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

Project Airstream is a study of radioactivity in the lower stratosphere employing the WB-57F aircraft as a sampling platform conducted by the Environmental Measurements Laboratory (formerly the Health and Safety laboratory). This report contains data from the missions flown in November 1976 and April 1977.

**22157** (EML—334, pp II.68-II.84) **High altitude balloon sampling program.** Leifer, R.; Toonkel, L.E. 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

The U.S. Department of Energy's program for measuring upper atmospheric nuclear debris collected by balloon-borne filtering devices has been in continuous operation since 1956. This report contains results from samples collected in calendar year 1976. Data on $^{7}Be$, $^{137}Cs$, and $^{144}Ce$ in the samples are included.

**22158** (EML—334(App.), pp A.1-A.40) **Quarterly $^{90}Sr$ deposition at world land sites.** 1 Jan 1978.

In Appendix to Environmental Measurements Laboratory environmental quarterly.

The Environmental Measurements Laboratory (formerly the Health and Safety Laboratory) has carried out a $^{90}Sr$ fallout sampling program since the middle 1950's. Through June 1976, the monthly collections were analyzed individually and a final report of these data was presented in HASL-329, October 1, 1977. This section presents the results of quarterly $^{90}Sr$ data at 79 sites beginning in 1976. Of the 79 sites for whicn quarterly data are reported, the monthly collections at 71 sites are composited and analyzed quarterly starting with the July 1976 samples. Data reported for the first half of 1976 at these sites as well as for the whole year at New York City and Australian sites, are quarterly results obtained by summing the monthly data.

**22159** (EML—334(App.), pp B.1-B.155) **Radionuclides and lead in surface air.** Feely, H.W.; Toonkel, L.E. 1 Jan 1978.

In Appendix to Environmental Measurements Laboratory environmental quarterly.

Since January 1963, the Environmental Measurements Laboratory (EML), formerly the Health and Safety Laboratory (HASL), has been conducting the Surface Air Sampling Program. The primary objective of this program is to study the spatial and temporal distribution of specific natural and man-made radioisotopes, and trace metals in the surface air. Other special studies of surface air contamination have been added during the course of the program. Data are included on the content of $^{7}Be$, $^{238}Pu$, $^{239}Pu$, $^{54}Mn$, $^{55}Fe$, $^{109}Cd$, $^{95}Zr$, $^{137}Cs$, and $^{144}Ce$, and stable Pb in samples of surface air.

**22160** (GJT—18) **Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Dec 1977. Contract EY-76-C-13-1658. 152p. Dep. NTIS, PC A08/MF A01.

Results are reported from an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Lakeview, Oregon site. Results are included from the analyses of soil, water, and other samples; radiometric measurements to determine areas with radium-contaminated materials; evaluation of resulting radiation exposures of individuals and nearby populations; investigation of site geology, hydrology, and meteorology; and evaluation and costing of alternative corrective actions. Radon gas release from the 130,000 tons of tailings at the Lakeview site constitutes the main environmental impact, which is minimal. The two alternative actions presented are maintenance of the site now that the ARCO reclamation program has been completed (Option I); and addition of stabilization cover to a minimum depth of 2 ft, improved fencing, and removal of a few isolated spots of contamination (Option II). The cost estimates for these options are $40,000 and $290,000, respectively.

**22161** (GJT—18S) **Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Dec 1977. Contract EY-76-C-13-1658. 43p. Dep. NTIS, PC A03/MF A01.

Results are reported from an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at the Lakeview, Oregon site. Data ore included from the analyses of soil, water, and other samples; radiometric measurements to determine areas with radium-contaminated materials; evaluation of resulting radiation exposures of individuals and nearby populations; investigation of site geology, hydrology, and meteorology; and evaluation and costing of alternative corrective actions. Radon gas release from the 130,000 tons of tailings at the Lakeview site constitutes the main environmental impact, which is minimal. The two alternative actions presented are maintenance of the site now that the ARCO reclamation program has been completed (Option I); and addition of stabilization cover to a minimum depth of 2 ft, improved fencing, and removal of a few isolated spots of contamination (Option II). The cost estimates for these options are $40,000 and $290,000, respectively.

**22162** (GJT—20) **Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I.** (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Dec 1977. Contract EY-76-C-13-1658. 130p. Dep. NTIS, PC A07/MF A01.

Results are reported from an engineering assessment of the problems resulting from the existence of radioactive uranium mill tailings at Ray Point, Texas. The Phase II--Title I services generally include the preparation of topographic maps, the performance of soil sampling and radiometric measurements sufficient to determine areas and volumes of tailings and other radium-contaminated materials, the evaluation of resulting radiation exposures of individuals and nearby populations, the investigation of site hydrology and meteorology and the evaluation and costing of alternative corrective actions. About

490,000 tons of ore were processed at this mill with all of the uranium sold on the commercial market. None was sold to the AEC; therefore, this report focuses on a physical description of the site and the identification of radiation pathways. No remedial action options were formulated for the site, inasmuch as none of the uranium was sold to the AEC and Exxon Corporation has agreed to perform all actions required by the State of Texas. Radon gas release from the tailings at the Ray Point site constitutes the most significant environmental impact. Windblown tailings, external gamma radiation and localized contamination of surface waters are other environmental effects. Exxon is also studying the feasibility of reprocessing the tailings.

**22163** (HASL—325) **Radon workshop, February 1977.** Breslin, A.J. (ed.). (Energy Research and Development Administration, New York (USA). Health and Safety Lab.). Jul 1977. 178p. (CONF-770231—). Dep. NTIS, PC A09/MF A01.

From Radon workshop; New York, NY, USA (Feb 1977). Separate abstracts were prepared for 30 papers presented.

**22164** (HASL—325, pp 2-3) **Radon/radon-daughter measurement methods and instrumentation.** Rock, R.L. (Mining Enforcement and Safety Administration, Denver). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Radon-daughter measurement equipment and techniques have been continuously improved over the last 25 years. Improvements have been in the areas of accuracy, time and convenience. We now have miniaturized scalers and detectors available for measuring the alpha particle count rates from aerosol samples collected on filter papers. We also have small lightweight efficient pumps for conveniently collecting samples and we have various counting methods which allow us to choose between making very precise measurements or nominal measurements. Radon-daughter measurement methods used in uranium mines and mills are discussed including a personal radon-daughter-exposure integrating device which can be worn by miners.

**22165** (HASL—325, pp 6-8) **Radon and daughter measurements with active and passive devices using track etch detectors.** Frank, A.L.; Benton, E.V.; Cassou, R. (Univ. of San Francisco, CA). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Of the $\alpha$ dosimeters employing cellulose nitrate track etch detectors which have been tested for measuring airborne radon and radon daughter activities, only the active device now gives reliable and accurate measurements of the type needed for practical dosimetry. The passive personnel dosimeters need improved sensitivity. The passive environmental dosimeters have experienced wide variations in response which are not fully understood. They might be of use where finer accuracy is not required.

**22166** (HASL—325, pp 9-16) **Methods used by HASL for ambient radon studies.** Breslin, A.J. (Energy Research and Development Administration, New York). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The techniques that are used by HASL in its environmental radon studies are tabulated, with brief descriptive information. Some of the techniques are used much more frequently than others and one or two are used only rarely. But taken altogether, the list represents the aggregate of methods that have been acquired over a number of years and have been applied to various aspects of radon studies as needed.

**22167** (HASL—325, pp 17-19) **Continuous and grab sampling determinations of radon concentrations.** Aitken, J.H.; Baker, E.G.; Lee, J.; Tai-Pow, J. Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

For grab sampling determinations of radon, 2.1 litre glass bottles are evacuated in the laboratory and opened to the atmosphere at the sampling location. On return to the laboratory, the sample bottle is connected via tubing containing drying agents and an isolation valve to an evacuated counting chamber. When the isolation valve is opened, the air sample is shared between the counting chamber and the sample bottle. Clean, aged air is then admitted to raise the system to atmospheric pressure. The counting volume is isolated again, the chamber disconnected from the sample bottle and coupled to the photomultiplier tube. A 1 Kv collection voltage is applied to the chamber for about four hours prior to counting, during which period equilibrium is established between radon and its short-lived daughters. Counting then proceeds overnight if the sample is low level or for an hour of two if it is high level. The counting chamber is an 8" diameter copper sphere with a built-in 2" diameter lucite window coated with ZnS scintillator.

**22168** (HASL—325, pp 20-21) **Survey of radon monitoring techniques.** Graveson, R.T. (Energy Research and Development Administration, New York). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The HASL monitor for measuring environmental levels of radon basically is a large "two filter" collector which has been automated. The first filter (24" diameter in this unit) removes the daughters and any particulate radioisotopes. The air then passes through a large chamber (approximately 240 liters) which allows a portion of the radon daughters to grow in. These are collected on a filter which is located on a strip-filter transport. The system collects the daughter sample on a two inch circle on the tape, then transports it to a position under a three inch scintillation detector for counting. The next sample is collected during the counting period. Normally, the sampling period is set for one hour and is followed by a one-hour count. Sensitivity is 0.005 pCi/liter radon with approximately a 10 percent standard deviation. The unit also can be cycled on two hour, thirty minute, or fifteen minute intervals.

**22169** (HASL—325, pp 22-24) **Environmental radon and thoron monitor.** Thomas, J.W. (Energy Research and Development Administration, New York). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

A large two-filter type monitor (ERM-3) has been developed for measuring environmental levels of radon and thoron to within several picocuries per cubic meter. The inlet filters of the monitor remove daughter activity from the entering air stream but permit radon and thoron to pass. Daughter activity formed in the 0.9 $m^3$ decay chamber is collected by the fixed exit filter. The alpha activity of the filter is detected with a zinc sulfide scintillator and a 12 cm phototube, counted with an automatic timer and scaler, and is printed out on a teletypewriter for predetermined counting intervals. The teletypewriter also punches a tape to provide computer-compatible readout.

**22170** (HASL—325, pp 25-30) **Passive environmental radon monitor.** George, A.C. (Energy Research and Development Administration, New York). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The development of a simpler environmental radon monitor based on the two-filter method which can measure average environmental radon concentrations over a one-week period is reported. The merits of the new monitor are low cost, good sensitivity, portability, and reliable, unattended operation. A complete unit can be assembled for about $50. The most expensive component is the battery, which costs about $30. Sensitivity is 0.03 picocuries of radon per liter of air in a one week exposure period. No external power is required. Operation is completely passive and the instrument can be left unattended during the entire period of exposure.

**22171** (HASL—325, pp 31-33) **3R-WL air sampling survey meter.** Schiager, K.J. (Univ. of Pittsburgh). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The design and operation of a direct-reading sampler for airborne radon progeny are described. The instrument was designed for use by ventilation personnel in uranium mines and is small, rugged, light-weight and easily carried and operated. Direct readout of the radon progeny concentration in units of working levels, in the range of 0.01 to 10 WL, is accomplished by counting the alpha particles from $^{218}Po$ and $^{214}Po$ with a single detector and two energy discrimination channels. Unique features include a fixed-volume, gravity-operated pump requiring no power source and minimal calibration, automatic decay, counting and display sequencing, capacity for more than 50 samples on a single roll of membrane filter, and provisions for recording all data directly on the filter tape.

**22172** (HASL—325, pp 34-36) **Some remarks on exact methods for WL and $^{222}Rn$-daughter determination.** Groer, P.G. (Argonne National Lab., IL). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

For an exact determination of the three $^{222}Rn$-daughter concentrations (RaA, B and C) which properly weighted yield the Working Level, three equations relating observed counts ($\alpha$ or $\beta$) to these unknown concentrations have to be solved. The half-lives in the $^{222}Rn$ decay series, the type of decay and the counting errors, limit the suitable set of equations. Some aspects of two such exact methods are discussed.

**22173** (HASL—325, pp 37-38) **Comparison of costs of integrating working level devices.** Langner, G.H. Jr. (Colorado Dept. of Health, Grand Junction). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

For the purpose of deciding upon the method for making routine field measurements of radon and radon daughter products there are primarily two factors to be taken into consideration: how well the various methods measure the parameter of interest and how much they cost. For the purpose of measuring the annual average working level within a structure there are available basically two devices: the integrating air sampler and track etch film. The cost and manpower requirements for each of these two devices are discussed.

**22174** (HASL—325, pp 39-42) **Comparison of errors of integrating working level devices.** Langner, G.H. Jr. (Colorado Dept. of Health, Grand Junction). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

For the purpose of deciding upon the method for making routine field measurements of radon and daughter product concentrations there are primarily two factors to be taken into consideration: how well the various methods measure the parameter of interest and how much they cost. Methods used to estimate the annual average working level inside a structure under normal conditions of occupancy are compared.

**22175** (HASL—325, pp 43-47) **Continuous working level monitor.** Droullard, R.F.; Holub, R.F. (Denver Mining Research Center). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The Bureau of Mines has developed a continuous working level monitor (CWLM) for measuring exposure levels of radon daughters in uranium mine environments. Airborne daughter products are collected on an open face filter using a constant airflow. The beta activity is measured from the back side of the filter with a pancake-type GM tube. This method does not measure all of the daughter products comprising a working level and it is, therefore, subject to inherent errors, which are discussed.

**22176** (HASL—325, pp 48-64) **Design and application of a continuous, digital-output, environmental radon measuring instrument.** Spitz, H.; Wrenn, M.E. (New York Univ., NY). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

A radon measuring instrument has been developed which can continuously measure environmental concentrations of radon in the atmosphere without employing any air movers or pumps. The unit is entirely passive in design and relies upon the diffusion of radon for sample collection. Since radon is an inert noble gas it will follow the classical theory of motion and diffuse in a direction dependent upon the concentration gradient existing between the atmosphere and the sensitive portion of the detector. A porous foam filter allows radon, but not its daughters, to enter the detector where an electrostatic field is maintained to facilitate collection of the decay products of radon, i.e., initially the positive ions of RaA (Po-218). Alpha particles from RaA and RaC' (Po-214) within the sensitive volume are detected using a ZnS scintillator and photomultiplier tube with the usual complement of electronics.

**22177** (HASL—325, pp 65-68) **Variation of radon and radon daughter concentrations with height above ground.** Gogolak, C.V. (Energy Research and Development Administration, New York). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Changes in the vertical radon and radon daughter concentration profiles produce changes in the natural background gamma- and beta-ray flux which in turn produces significant perturbations in both ground and aerial monitoring results. Also, there long has been interest in using radon as a tracer, and substantial effort has been expended in studying radon diffusivity. Results are reported from a series of experiments in which the $^{222}Ra$ decay products, $^{218}Po$, $^{214}Pb$, and $^{214}Bi$, were measured simultaneously at heights of 1, 10, and 25 meters.

**22178** (HASL—325, pp 69-71) **What do we sample for and for how long.** Hazle, A.J. (Colorado Dept. of Health, Denver). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

In the case of exposure of the general public to radon and radon daughters several methods have been devised to estimate annual average doses. The performance of TLD equipped samplers is discussed.

**22179** (HASL—325, pp 73-77) **Radiation surveys in contaminated communities.** Knight, G.B. (Atomic Energy Control Board, Ottawa). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Radiation surveys of uranium contamination in Uranium City and Port Hope, Canada, are described. Samples of soil, water, and crops grown in contaminated soil and air in homes were analyzed for radon content. Following decontamination, measurements were made of $\gamma$ exposure rates both inside and outside of buildings.

**22180** (HASL—325, pp 78-89) **Radon and radon daughters: measurement and analysis successes and difficulties experienced by EPA.** Duncan, D.L. (Office of Radiation Programs, Washington, DC). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Methods used by the Environmental Protection Agency for collecting samples of breath, surface air, and water for analysis for radon and daughter products are reviewed.

**22181** (HASL—325, pp 90-101) **Atmospheric characteristics essential for health effects modeling.** Nelson, N.S. Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Factors to be considered in evaluating the possible consequences of exposure of human populations to radioactive aerosols are reviewed. Mathematical models of the mechanisms of radioinduced carcinogenesis, tissue deposition and lung clearance of radioactive aerosols, and meteorological parameters affecting the diffusion of radioactive aerosols in the atmosphere are discussed.

**22182** (HASL—325, pp 105-107) **Instrumentation use in the uranium mill tailings program in Colorado.** Franz, G.A. III. (Colorado Dept. of Health, Grand Junction). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

A brief summary of the instruments used in the Uranium Mill Tailings Program to measure gross gamma and alpha radiation from radon and radon daughters is presented.

**22183** (HASL—325, pp 108-109) **Background working levels and the remedial action guidelines.** Peterson, B.H. (Colorado Dept. of Health, Grand Junction). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The Grand Junction, Colorado, Remedial Action Program uses radon daughter concentrations of 0.01 Working Level (WL) above background for residences and 0.03 WL above background for other structures. To date, 0.007 WL has been used as background, based on the mean value determined from some 50 control locations. As long as the radon daughter levels in remedial locations are well in excess of the minimum action levels, 0.007 WL is quite adequate. However, it is neither adequate nor appropriate when the observed levels approach the lower guidelines or for post-remedial successfulness evaluation. Background is, in fact, a range of values. The actual background level for a particular location cannot be determined, only the probability of its being greater than or less than a certain value.

**22184** (HASL—325, pp 110-113) **Radon levels and ventilation effects in underground enclosures.** Wilkening, M. (New Mexico Inst. of Mining and Tech., Socorro). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Radon-222 levels in two underground enclosures differing widely in type, size, and configuration are reviewed briefly. One is the Workman Mine, New Mexico, and the other is the Carlsbad Caverns.

**22185** (HASL—325, pp 114-128) **Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves.** Yarborough, K.A. (National Park Service, Santa Fe, NM). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The National Park Service (NPS) is studying levels of airborne alpha radiation from radon and thoron in all NPS administered caves in which tours for visitors are regularly conducted. The NPS research has the dual but complementary objectives of safeguarding health at the NPS administered caves, and to develop data on alpha radiation levels and on natural airflows in NPS caves. The results reported here for NPS caves describe concepts hypothesized for the objectives. In addition the data can be used by various agencies to clarify health standards for exposures to low airborne alpha radiation levels in cave environments. These results show daily and seasonal trends and the influence of natural ventilation by air circulation for each cave investigated.

**22186** (HASL—325, pp 129-131) **Radon concentrations in contaminated and uncontaminated premises in two Ontario towns.** Aitken, J.H.; Baker, E.G.; Chatterjee, R.M.; Kusiak, R.; Tai-Pow, J. Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Radon-222 concentrations in air were measured by grab sampling in a large number of private homes and other buildings in the town of Port Hope, Ontario. The purpose of the measurements is to

identify places where a health hazard might exist due to improper disposal of radium-contaminated materials. Contaminated fill, rubble, lumber, and other building materials have been found in a number of premises in the town. Radon concentrations up to 750 pCi/l have been found in some homes. The thrust of the program is to identify quickly places where concentrations might be high enough to justify some prompt interim remedial action such as installation of special ventilation systems, pending final remedial work by removal of the contamination. The methods and instrumentation immediately available are those formerly used for radon-in-breath analysis in radium workers. Grab sampling for radon and gamma surveying in every building in town are used together in a screening program. Experience showed that both radon sampling and gamma surveying are required to identify contaminated locations.

**22187** (HASL—325, pp 141-148) **$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan.** Taniguchi, H. (Radiation Protection Bureau, Ottawa). Jul 1977.
From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

The results of a preliminary survey of all homes and buildings in Uranium City, Canada, for radon daughters are presented. It was found that 164 of these out of 552 examined (30 percent) had concentrations greater than or equal to 0.02 WL. The number equal to or greater than 0.05 WL was 65 (12 percent). The equilibrium ratio for a majority of the homes measured during the late winter and early spring when the doors and windows were still usually closed ranged from 0.30 to 0.50. The source of the radon appears to be from the use of crushed rock containing non-economic grades of uranium which has been used on laneways, walks, roads and backfill. Natural occurrences of radioactive ores may also be contributing radon to some of the homes.

**22188** (HASL—325, pp 155-160) **Application of field spectrometry to radiation studies in phosphate regions.** Lowder, W.M. (Energy Research and Development Administration, New York). Jul 1977.
From Radon workshop; New York, NY, USA (Feb 1977). In Randon workshop, February 1977.

Methods are described that were used for monitoring environmental levels of $^{222}$Ra and daughter products in Polk County, Florida, where the use of phosphate mine tailings in construction materials has resulted in high levels of radioactivity in buildings and surface air.

**22189** (HASL—325, pp 4-5) **Radon and radon daughter measurements and methods utilized by EPA's Eastern Environmental Radiation Facility.** Phillips, C.R. (Eastern Environmental Radiation Facility, Montgomery, AL). Jul 1977.
From Radon workshop; New York, NY, USA (Feb 1977). In Randon workshop, February 1977.

The Eastern Environmental Radiation Facility (EERF), Office of Radiation Programs, has the responsibility for conducting the Environmental Protection Agency's study of the radiological impact of the phosphate industry. Numerous measurements in structures constructed on land reclaimed from phosphate mining showed that working levels in these structures range from 0.001 to 0.9 WL. Sampling is performed by drawing air through a 0.8 micrometer pore size, 25 mm diameter filter at a flow rate of 10 to 15 liters/minute for from 5 to 20 minutes, depending on the daughter levels anticipated. The detection system consists of a ruggedized silicon surface barrier detector (450 mm$^2$-100 micrometer depletion) connected through an appropriate pre-amplifier-amplifier to a 1024-channel multichannel analyzer. Other measurement methods are also discussed.

**22190** (HASL—325, pp 161-164) **Ventilation measurements as an adjunct to radon measurements in buildings.** Knutson, E.O.; Franklin, H. (Energy Research and Development Administration, New York). Jul 1977.
From Radon workshop; New York, NY, USA (Feb 1977). In Randon workshop, February 1977.

The concentration of radon in a building is a function of the radon sources within the building and of the building's ventilation characteristics. To complement its radon measurement program, HASL is currently assessing apparatus and procedures for measuring building ventilation. Results are reported from ventilation measurements made in the laboratory and in a residential building.

**22191** (NYO—3425-14) **Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974—31 July 1975.** Reiter, R.; Kanter, H.J.; Sladkovic, R.; Poetzl, K. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (Germany, F.R.). Inst. fuer Atmosphaerische Umweltforschung). Mar 1977. Contract EY-76-C-02-3425. 98p. Dep. NTIS, PC A05/MF A01.

Continuous data of the radionuclides 7Be, 32P, 33P, 35S and of fallout, as well as tentative data of the ozone concentration are given for the reporting period. A new Ge(Li) Gamma Spectrometer, permitting the routine monitoring of the fallout composition is described. A method is set forth for the forecast of influxes of stratospheric air to a certain place on the earth surface. The forecasting quality is subjected to continuous checking. A first analysis of the ozone concentration in correlation with the 7Be concentration reveals a seasonal trend. However, due to the relatively small amount of data available thus far, the results are not yet statistically established. A five-year study resulted in hardly any promising approaches are offered which will permit the deriving of causal relationships between solar events and the meteorological phenomena being connected therewith.

**22192** **Monte Carlo simulation of turbulent atmospheric transport: comparison with experimental data.** Alsmiller, R.G. Jr.; Alsmiller, F.S.; Bertini, H.W.; Begovich, C.L. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 117-119(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22193** **Applicability of accepted diffusion models to near stack dose calculations.** Rubin, M.P. (Univ. of California, Los Angeles). *Trans. Am. Nucl. Soc.;* **27**: 119-120(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22194** **Jeremiah Environmental Computational System.** Buckner, M.R. (Savannah River Lab., Aiken, SC). *Trans. Am. Nucl. Soc.;* **27**: 122-123(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22195** **Estimation of $^{222}$Rn daughter doses from large-area sources.** Horton, T.R. (Environmental Protection Agency, Montgomery, AL). *Trans. Am. Nucl. Soc.;* **27**: 132-133(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22196** **Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants.** Eckart, L.E.; Capano, L. (Univ. of Cincinnati, OH). *Trans. Am. Nucl. Soc.;* **27**: 136-137(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22197** **Radiological effluent and environmental monitoring for uranium mills: a regulatory viewpoint.** Hickey, J.W.N. (U.S. Nuclear Regulatory Commission, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 149-150(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

## REGULATIONS

*REFER ALSO TO CITATION(S) 21435, 21688*

# ENVIRONMENTAL SCIENCES, TERRESTRIAL

## BASIC STUDIES

**22198** (COO—2307-13) **Endangered and threatened plant species of the Nevada Test Site, Ash Meadows, and central-southern Nevada.** Beatley, J.C. (Cincinnati Univ., Ohio (USA). Dept. of Biological Sciences). Jul 1977. Contract EY-76-S-02-2307. 12p. Dep. NTIS, PC A02/MF A01.

Three plant species included among the Nevada Threatened or Endangered Flora of the Federal Register list of July 1, 1975, were omitted from the recent reports dealing with these groups of plants in central-southern Nevada. Two of the species, Ephedra funerea and Mirabilis pudica, were not included because they are both widely distributed and locally common in southern Nevada and were understood (unofficially) to be no longer considered candidates

for either an Endangered or Threatened status. The third species, Machaeranthera ammophila, is now included with M. arida, an uncommon species of central and eastern Mojave Desert of southern California (to southern Nevada, Arizona, and Sonora), and is therefore no longer a candidate for the status of Threatened Species in Nevada.

**22199 Old field vegetation as an inhibitor of tree vegetation.** Richards, N.A. (State Univ. of New York, Syracuse). pp 78-88 of In Power lines and the environment. Goodland, R. (ed.). Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973).

From American Institute of Biological Sciences meeting; Amherst, MA, USA (21 Jun 1973).

See CONF-730650—P1.

When trees were planted in old fields abandoned from agriculture, it was learned that old field herbaceous communities severely retarded the establishment of many trees. Mass tree planting is now declining and increasing effort devoted to fighting back tree invasion to maintain open land for roadsides and other rights-of-way. Interest in reforestation of old fields has shifted to interest in a variety of vegetation communities. The significance of perennial meadows for preventing unwanted invasion of trees is discussed. (HLW)

## CHEMICALS MONITORING AND TRANSPORT

*REFER ALSO TO CITATION(S) 21025, 22148, 22211, 22273*

## RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

*REFER ALSO TO CITATION(S) 22188*

**22200** (HASL—325, pp 149-154) **Measurements of $^{222}$Rn flux with charcoal coanisters.** Countess, R.J. (Energy Research and Development Administration, New York). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Randon workshop, February 1977.

Methods used to measure the $^{222}$Rn flux from the ground are discussed. The most common method is the direct accumulation of radon in a closed container resting on the soil surface. An aliquot of the air is transferred from the accumulator either to an ionization chamber or to an alpha scintillation flask for radon analysis. An alternate method consists of entraining the radon emanating from a small area of the ground in an airstream moving in a closed system through a charcoal trap or cold trap. At the end of the sampling period, the trap is sealed and returned to the laboratory where the radon is transferred into an evacuated scintillation flask for analysis. Still another method consists of adsorbing radon in a layer of granular, activated charcoal spread directly on the ground. For analysis, the charcoal is bagged and the 0.61-MeV gamma activity of $^{214}$Bi (RaC) is measured in a gamma spectrometer. These last two methods have the disadvantage that some radon may be lost in transfer prior to analysis. In an improved method, which is simpler than the preceding methods and eliminates this transfer problem, a modified U.S. Army M11 gas mask canister containing activated charcoal is placed directly in contact with the emanating surface and after an exposure period from several hours to several days, depending on the anticipated flux density, the canister is removed from the surface and counted directly in a gamma spectrometer. In addition to precluding losses in sample transfer, a major advantage is that numerous measurements can be made inexpensively due to the low cost of the canisters and their ease of deployment and recovery.

### SOIL

*REFER ALSO TO CITATION(S) 21166, 21201, 21207, 21210, 22160, 22161, 22162*

**22201** (UCRL—51879(Pt.3)) **Evaluation of the radionuclide concentrations in soil and plants from the 1975 terrestrial survey of Bikini and Eneu Islands.** Colsher, C.S.; Robison, W.L.; Gudiksen, P.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Jan 1977. Contract W-7405-ENG-48. 118p. Dep. NTIS, PC A04/MF E01.

In June 1975 a radiological survey was conducted of the terrestrial environment of Bikini and Eneu islands (Bikini Atoll) to evaluate the potential radiation dose to the returning Bikini population. In this report, we present measurements of the radionuclide concentration in soil profiles and in dominant species of edible and nonedible, indicator plants. The use of these data to derive relationships to predict the plant uptake of radionuclides from soil is described. Approximately 620 soil and vegetation samples from Bikini and Eneu Islands were analyzed by Ge(Li) gamma spectrometry and by wet chemistry. The predominant radionuclides in these samples were $^{60}$Co, $^{90}$Sr, $^{137}$Cs, /sup 239,240/Pu, $^{241}$Pu, and $^{241}$Am.

**22202 Measuring low concentrations of plutonium and americium in earth samples.** Untermyer, S. (National Nuclear Corp., Redwood City, CA); Bruns, L.E.; Klein, A.S. *Trans. Am. Nucl. Soc.;* **27**: 116-117(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22203** (ORNL-tr—4518) **Natural radioactivity of some soils in landscapes of the kolochnaya forest-steppe of the Tambov region.** Yastrebov, M.T. Translated from *Vestn. Mosk. Univ., Biol., Pochvoved.;* **28**: No. 6, 91-96(1973). 11p. Dep. NTIS, PC A02/MF A01.

The complex hydromorphic meadow soils of the Kilochnaya forest-steppe, made up of swamp and meadow solods, chernozem-meadow solonetzic, chernozem-meadow and chernozemic floodplain soils, are widely distributed in the upper reaches of the Bityug River in the Tokarev area of the Tambov region. Information is presented on the content and distribution of $^{238}$U, $^{226}$Ra, $^{232}$Th, and $^{40}$K in the soil.

### TERRESTRIAL ECOSYSTEMS AND FOOD CHAINS

*REFER ALSO TO CITATION(S) 22143, 22152, 22155, 22201, 22279*

**22204** (EML—334, pp III.3-III.6) **Cesium-137 in various Chicago foods (collection month: October 1977).** Karttunen, J.O. (Argonne National Lab., IL). 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

Since April 1961, the $^{137}$Cs and potassium content of the Chicago portion of the Tri-City Diet Sampling Program has been determined in bulk food samples by gamma-ray spectrometry using a 4" x 4" NaI (TI) crystal. Each variety of food (all fresh vegetables, all fresh fruit, etc.) is composited before measurement, and each sample is counted 400 to 1000 minutes. From these measurements composite daily and yearly food intakes are obtained. The results for the October 1977 semi-annual sampling are tabulated.

**22205** (EML—334(App.)) **Appendix to Environmental Measurements Laboratory environmental quarterly.** (Department of Energy, New York (USA). Environmental Measurements Lab.). 1 Jan 1978. 207p. Dep. NTIS, PC A10/MF A01.

Separate abstracts were prepared for three sections of this report. A list of radionuclides of interest in environmental programs and conversion tables for units of measurements are included.

**22206** (EML—334(App.), pp C.1-C.7) **Radiostrontium in milk and tap water.** 1 Jan 1978.

In Appendix to Environmental Measurements Laboratory environmental quarterly.

In 1954, the Environmental Measurements Laboratory (formerly the Health and Safety Laboratory) began monitoring liquid whole milk in New York City for strontium-90 in order to estimate the dietary contribution from the ingestion of this radionuclide from this source. During the same year, tap water sampling was begun on a routine basis at the laboratory, which receives its supply from one of the main reservoirs servicing New York City. Milk and tap water analyses in New York City have been continued in order to provide a detailed and continuous history of the contamination levels of these staples. Data through June 1977 are presented.

**22207** (PNL—2383) **Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971—1975.** Fix, J.J.; Leete, S.C.; Bramson, P.E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1977. Contract EY-76-C-06-1830. 35p. Dep. NTIS, PC A03/MF A01.

To assess the public's potential exposure to radionuclides from Hanford operations, a variety of foodstuffs including milk, meat, chickens, eggs, and leafy vegetables have routinely been collected from the Hanford environs. Radionuclides observed included naturally-occurring $^{40}$K, as well as the radionuclides $^{90}$Sr and $^{137}$Cs contributed by worldwide fallout. Radionuclides of Hanford origin would be similar to those from fallout and must necessarily be present in greater levels than the fallout nuclides to be detectable. Data on radioactivity for each foodstuff category is examined separately.

**22208 Evaluation of models for assessing compliance with environmental radiation regulations.** Hoffman, F.O.; Shaeffer, D.L.; Miller, C.W.; Garten, C.T. Jr. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 120-122(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## SITE RESOURCE AND USE STUDIES

*REFER ALSO TO CITATION(S) 20914, 21681, 21682, 21684, 21685, 21692, 22160, 22161, 22162*

**22209 Recapturing radio-tagged ruffed grouse by nightlighting and snow-burrow netting.** Huempfner, R.A.; Maxson, S.J.; Erickson, G.J.; Schuster, R.J. *J. Wildl. Manage.;* **39**: No. 4, 821-823(Oct 1975).

This paper describes two new techniques for capturing ruffed grouse (Bonasa umbellus). Use of these and several established methods makes capture of radio-tagged grouse possible throughout the year.

## REGULATIONS

*REFER ALSO TO CITATION(S) 21420, 21421, 21425, 21435, 21685, 21688*

# ENVIRONMENTAL SCIENCES, AQUATIC

## BASIC STUDIES

**22210** (ANL/ES—61) **Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs.** Murarka, I.P.; Bodeau, D.J. (Argonne National Lab., Ill. (USA)). Nov 1977. Contract W-31-109-ENG-38. 92p. Dep. NTIS, PC A05/MF A01.

This report contains a description of three computer programs that implement the theory of sampling designs and the methods for estimating fish-impingement at the cooling-water intakes of nuclear power plants as described in companion report ANL/ES-60. Complete FORTRAN listings of these programs, named SAMPLE, ESTIMA, and SIZECO, are given and augmented with examples of how they are used.

## CHEMICALS MONITORING AND TRANSPORT

*REFER ALSO TO CITATION(S) 20911, 21019, 21020, 21021, 21023, 21024, 21025, 21027, 21030, 21031, 21033, 21034, 21051, 21925, 22225, 22227, 22269, 22270, 22271, 22273, 22275, 22276*

**22211** (CONF-730386—, pp 827-834) **Fate of a bunker fuel in beach sand.** Guard, H.E.; Cobet, A.B. (Univ. of California, Berkeley). 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

The dispersed oil concentrations in sand from three San Francisco area beaches have been measured over a 143 day period following an 840,000 gallon bunker fuel spill in San Francisco Bay. The dispersed oil remaining within the beaches after cleanup was extensively weathered while visible oil globules exhibited only minor weathering. Elevated levels of chloroform-extractable material were observed at two sampling locations following the spill. The background levels of chloroform-extractable materials determined from log-normal distribution analysis were ten-fold higher on bay beaches than on ocean beaches. Laboratory experiments indicated that in a beach system evaporation, dissolution, and microbial degradation combine to remove the lower molecular weight fractions of bunker fuel. A major effect of the beach is to disperse the oil. This dispersal has been shown to greatly enhance the effect of dissolution on the composition of bunker fuel. While the effect of exposure to water on the composition of a bunker fuel slick is minimal, significant amounts of the lower ends of bunker fuel (which is highly dispersed) in a sand column are removed by dissolution.

**22212** (PB—269652) **Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76.** Howe, L.H. (Tennessee Valley Authority, Chattanooga (USA). Div. of Environmental Planning). Apr 1977. 45p. (TVA-E-EP—77-3). NTIS PC A03/MF A01.

A differential pulse polarographic method was developed for determining total arsenic concentrations in water samples from ash ponds at steam-electric generating plants. After digestion of the sample and isolation of arsenic by solvent extraction, the peak current for arsenic is measured and compared to a standard curve. The effective range of concentrations for this method is from 2 to 50 ug/l of arsenic. The precision and accuracy of this polarographic method for determining concentrations of arsenic in water samples were compared to two standard methods, atomic absorption and colorimetry, for observations on replicate analyses of pure standard solutions, split samples from ash ponds, standard reference samples, and standard solutions spiked with potentially interfering elements. The three methods compared favorably for the split samples; however, results of the colormetric method for the replicate analyses were slightly negatively biased.

**22213** (PB—269902) **Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report.** (Environmental Protection Agency, Chicago, Ill. (USA). Region V). 5 Jan 1977. 16p. (EPA—905/4-77/002). NTIS PC A02/MF A01.

Analytical procedures for measuring concentrations of the title metals in environmental samples are described. Results obtained using the flameless atomic absorption procedures are compared to data obtained using the referee method as defined in the October 16, 1973, Federal Register. It is concluded that the flameless atomic absorption methods are equivalent or superior to the referee procedure for these metals.

**22214** (RLO/2229/T1—41) **Review of the chemical speciation of copper in seawater.** Burrell, D.C. (Alaska Univ., Fairbanks (USA). Inst. of Marine Science). 1977. Contract EY-76-S-06-2229-001. 43p. Dep. NTIS, PC A03/MF A01.

Recent determinations of supposed total soluble copper in seawater lie in the range 0.1-0.5 $\mu g\ l^{-1}$. Inorganic chloro complexation is believed to predominate in marine water and the free cupric ion fraction should be very low. Organo complexation may be of importance in freshwater and of local significance in polluted estuarine waters. The presence of a biologically significant organically bound fraction has also been advocated for areas of high productivity or elevated organic detritus. Under "average" open ocean conditions, however, non-inorganic soluble speciation should be insignificant. Copper is readily partioned onto the particulates, particularly biogenous material, and such scavenging is believed to be the primary control on seawater concentrations. There is evidence for the remobilization of this metal from the surface sediments back into the water column.

**22215** (TID—22790) **Suspended particulates and natural radionuclides as tracers of pollutant transports in Continental Shelf waters of the Eastern U.S.A.** Biscaye, P.E.; Olsen, C.R.; Mathieu, G. (Columbia Univ., Palisades, N.Y. (USA). Lamont-Doherty Geological Observatory). 1977. Contract EY-76-S-02-2185. 28p. Dep. NTIS, PC A03/MF A01.

Preliminary results are reported from a study of the dispersion of anthropogenic pollutants by examining the suspended particulate phases with which many pollutants are associated and on which they are transported in the marine environment. The populations of suspended particle types, their distributions and their associations with trace metal pollutants have been analyzed by examining individual particles using combined scanning electron microscopy (SEM) and energy-dispersive x-ray fluorescence (EDXRF). The distribution of discrete pollutant particles, e.g., Ti-oxides and trace-metal bearing organic particles, which have their origins in the Apex of the New York Bight, suggest paths by which these pollutants are dispersed across the continental shelf. Gross features of surface and near-bottom suspended particle concentrations reflect vertical and horizontal mixing processes and indicate a flux of particles both into and out of the sediments. The distribution of $^{222}Rn$, a naturally radioactive tracer, which also has a flux from the sediments (particularly fine-grained sediments), was similar to that of near-bottom suspended particles. It was concluded that modelling the dispersion of radon will yield information on the rates of dispersion and removal of suspended particulates from the water column.

**22216 Simulation of chlorinated water discharges from power plants on estuaries and rivers.** Eraslan, A.H. (Univ. of Tennessee, Knoxville); Lietzke, M.H.; Fischer, S.K.; Kalmaz, E.V. *Trans. Am. Nucl. Soc.;* **27**: 141-142(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22217 Hydrospheric trace elements and their application in tracing water pollutants.** Chick, S.W.K.; Loveland, W. (Oregon State Univ., Corvallis, OR). *Trans. Am. Nucl. Soc.;* **27**: 173-174(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22218 Comparison of the bromide ion and iodide ion neutron activable tracers with tritiated water as groundwater tracers.** Jester,

W.A.; Raupach, D.C. (Pennsylvania State Univ., University Park). *Trans. Am. Nucl. Soc.;* **27**: 174-175(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22219** **Environmental significance of fin erosion in Southern California demersal fishes.** Sherwood, M.J.; Mearns, A.J. (Southern California Coastal Water Research Project, El Segundo). *Ann. N.Y. Acad. Sci.;* **298**: 177-189(1977).

From Conference on aquatic pollutants and biologic effects with emphasis on neoplasia; New York, NY, USA (27 Sep 1976).

See CONF-7609167—.

The Dover sole was the species most often affected with eroded fins. Prevalence of the disease was highest on the Palos Verdes shelf, the site of a major municipal waste water discharge. Fin lesions in this species were characterized by a minimal inflammatory response and by the absence of associated microorganisms. The fins most frequently affected were those most often in contact with bottom sediments. Diseased specimens from the shelf had higher levels of total DDT and a tendency toward higher levels of total PCB in muscle tissue and a greater liver to body weight ratio than did unaffected specimens from the same area. Laboratory exposure of M. pacificus to contaminated sediments from the shelf resulted in the development of fin erosion. Chlorinated hydrocarbon levels and liver weight to body weight ratios in the exposed fish approached those measured in fish from the shelf. These studies suggest that fin erosion in M. pacificus is caused by exposure to contaminated sediments and that the role of chlorinated hydrocarbons should be tested directly in future experiments.

## RADIOACTIVE MATERIALS MONITORING AND TRANSPORT

*REFER ALSO TO CITATION(S) 22160, 22161, 22162, 22188, 22197*

**22220** (COO—3568-18) **Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976—September 30, 1977.** Bowen, V.T. (Woods Hole Oceanographic Institution, Mass. (USA)). 1977. Contract EY-76-S-02-3568. 28p. Dep. NTIS, PC A03/MF A01.

The primary purpose of studying the biogeochemical behavior of transuranic radionuclides in large freshwater lakes began with studies of the distribution of these radionuclides, essentially introduced from the fallout of atmospheric nuclear weapons tests, in Lake Ontario. The recognition that an additional source of supply of these nuclides to Lake Ontario (subsequent to their release into Lake Erie) existed in the form of leakage from the Nuclear Fuel Services reprocessing plant at Springville, New York, led to expansion of the program to include sampling at the eastern end of Lake Erie. Much of the program is devoted to studies of the distribution of these nuclides in the lake sediments as they appear to be a major repository for transuranics in freshwater lakes. The extent to which this is a temporary or permanent repository is illuminated by studies of transuranic distributions in the lake waters and biota.

**22221** (HASL—325, pp 132-140) **Measurements of $^{222}$Rn in water and indoor airborne $^{222}$Rn originating in water.** Gesell, T.F.; Prichard, H.M. (School of Public Health, Houston, TX). Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977).

In Radon workshop, February 1977.

Results are reported from studies on domestic water as a contributor to indoor airborne radon-222. Emphasis is placed on the water → air → respiration pathway. Radon is somewhat soluble in water, but it will readily enter the air upon heating, agitation, or aeration, conditions which typically exist in household uses of water.

**22222** **Identification of petroleum oils by fluorescence spectroscopy.** Frank, U. (Environmental Protection Agency, Edison, NJ). pp 87-91 of In 1975 conference on prevention and control of oil pollution. Washington, DC; American Petroleum Inst. (1975).

From Conference on prevention and control of oil pollution; San Francisco, CA, USA (25 Mar 1975).

See CONF-750386—.

A simple and rapid method for the identification of weathered petroleum oils (passive tagging) by fluorescence spectroscopy is described. The approach used takes advantage of the three-dimensional character of the oil fluorescence spectra. Oil identification methods of other investigators that use fluorescence spectroscopy are also reviewed within the context of the three-dimensional system. The method involves excitation of the oils at 15 wavelengths, between 220-500 nanometers (nm), at 20-nm intervals. The emission monochromator is rapidly scanned at each excitation wavelength to obtain an emission spectrum. The maximum emission intensities are then plotted versus the excitation wavelengths to derive silhouette profiles. These are used as fingerprints for passive tagging petroleum oils. The influence of weathering, quenching, and solvent effects on the method are also examined.

### WATER

*REFER ALSO TO CITATION(S) 22143, 22155, 22205, 22206*

**22223** (ARH-LD—162) **Hanford groundwater transport estimates for hypothetical radioactive waste incidents.** Arnett, R.C.; Brown, D.J.; Baca, R.G. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jun 1977. Contract EY-76-C-06-2130. 36p. Dep. NTIS, PC A04/MF A01.

This report presents an analysis of the impact of subsurface contamination resulting from a series of hypothetical leaks or accidents involving Hanford high-level radioactive defense waste. Estimates of the amounts and concentrations of radionuclides reaching the Columbia River through the Hanford unconfined aquifer flow path were obtained by means of predictive models. The results of the study showed that the spatially averaged concentrations of $^{99}$Tc, $^{3}$H, and $^{106}$Ru in the ground water as it discharges into the Columbia River are at all times far below the respective ERDA Manual Chapter 0524 Concentration Guides for uncontrolled areas. Upon entering the Columbia River, additional large dilutions of the water containing trace quantities of contaminants will occur.

**22224** (N—77-26934) **Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457.** Vanhemmen, J.J.; Vanhoek, L.P.; Aten, J.B.T. (Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab. TNO). 1976. Contract A75/KL/080. 14p. (MBL—1976-10; TDCK—68321). NTIS PC A02/MF A01.

The relationship between the meter indications and the radioactivity of fission products in drinking water for the combination contamination meter IM 4457 and liquid counter M2H was investigated. The experimental setup is presented, the efficiency of the liquid counter for a mixture of fission products is briefly dealt with, and the use of the combination counter/meter in the field is discussed.

**22225** (PB—270423) **Drinking water and health. Part II, Chapters 6 and 7. A report of the safe drinking water committee. Final report.** (National Research Council, Washington, D.C. (USA)). 1977. Contract EPA-68-01-3169. 527p. NTIS PC A23/MF A01.

Partial contents include: herbicides; insecticides; fungicides; fumigant; other organic constituents; background radiation; abundance of radionuclides in water; radiation dose calculations; estimation of risk; and risks from radioactive drinking water.

**22226** **Environmental radioactivity from hospitals.** Claridge, D.E. (Univ. of California, Los Angeles); Kendrick, H.; Leventhal, L. *Trans. Am. Nucl. Soc.;* **27**: 137(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### AQUATIC ECOSYSTEMS AND FOOD CHAINS

*REFER ALSO TO CITATION(S) 22207*

**22227** **Radionuclide geochronology and pollution history recorded in lake sediments.** Edgington, D.N. (Argonne National Lab., IL); Robbins, J.A. *Trans. Am. Nucl. Soc.;* **27**: 117(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## THERMAL EFFLUENTS MONITORING AND TRANSPORT

**22228** (CONF-770961—3) **Isolation of pathogenic Naegleria from artificially heated waters.** Tyndall, R.L.; Willaert, E.; Stevens, A.R.; Coutant, C.C. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 19p. Dep. NTIS, PC A02/MF A01.

From Microbiology of power plant thermal effluents; Iowa City, IA, USA (19 Sep 1977).

Investigations were undertaken to determine whether heated waters facilitate the proliferation of free-living amoeba that cause primary amoebic meningoencephalitis. Water samples were taken close to the discharges of power plants situated on lakes or rivers in Florida and Texas and from cooling towers in Tennessee. The water temperatures ranged from 29 to 42°C. Water samples were also taken from several lakes in Florida and Texas without associated power plants. The water temperatures of these ranged from 30° to

34°C. Twenty-five-250-ml samples were filtered through membranes. Samples taken from the control lakes and cooling towers showed no growth of pathogenic amoeba, whereas growth was obtained from 2 of the 8 lakes and rivers in Florida and from 1 of the 7 man-made lakes in Texas that were artificially heated. The amoebae were identified as belonging to the genus Naegleria from their trophozoite and cyst structure, ability to grow at 45°C, to transform into flagellates, and to produce primary amebic meningoencephalitis (PAME) in mice after intranasal instillation. Their identification as N. fowleri was confirmed by indirect immunofluorescent analysis with antiserum produced against N. fowleri. These findings indicate that artificial heating of waters may facilitate the growth of pathogenic free living amoeba.

**22229 Thermal impact assessment of multi-power plant operations on estuaries.** Eraslan, A.H.; Kim, K.H.; Harris, J.L. (Univ. of Tennessee, Knoxville). *Trans. Am. Nucl. Soc.;* **27**: 140-141(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## SITE RESOURCE AND USE STUDIES

*REFER ALSO TO CITATION(S) 21694*

## REGULATIONS

*REFER ALSO TO CITATION(S) 21021, 21024, 21435*

# ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

*REFER ALSO TO CITATION(S) 21542, 21547, 21694*

## SOCIAL AND ECONOMIC STUDIES

*REFER ALSO TO CITATION(S) 21429, 21431, 21680, 21681, 21682, 21722*

## ASSESSMENT OF ENERGY TECHNOLOGIES

*REFER ALSO TO CITATION(S) 21415, 21420, 21430, 21717*

**22230** (DOE/EV—0030) **Environmental control technology activities of the Department of Energy in FY 1977.** (Department of Energy, Washington, D.C. (USA). Div. of Environmental Control Technology). Nov 1977. 88p. Dep. NTIS, PC A05/MF A01.

The Department of Energy is responsible for the research, development, and demonstration of emerging energy technologies and the promotion of energy conservation. An integral and significant part of that responsibility includes the balancing of energy goals with environmental requirements to protect and enhance the general health, safety, and welfare of the nation. This requires that environmental effects be considered and mitigating measures be taken in all energy processes through incorporation of environmental and safety controls which are developed as an integral part of energy system design. This inventory of environmental control technology activities was initiated by the Administrator, ERDA, prior to the incorporation of that administration within the Department of Energy. This compilation of total Energy Research and Development Administration (ERDA) environmental control technology activities, and associated funding, related to environmental control technology identifies the resources committed by ERDA to demonstrate its objective to protect and enhance the general health, safety, and welfare of the nation in the research, development, and demonstration of energy systems. Only ERDA research, development, and demonstration activities are covered in this report. The compilation for FY 1978 will encompass all of the DOE activities.

## ENVIRONMENTAL IMPACT STATEMENTS

*REFER ALSO TO CITATION(S) 20912*

# BIOMEDICAL SCIENCES, BASIC STUDIES

## BIOCHEMISTRY

*REFER ALSO TO CITATION(S) 21976*

**22231 Translation of the RNAs of brome mosaic virus: the monocistronic nature of RNA1 and RNA2.** Shih, D.S.; Kaesberg, P. (Univ. of Wisconsin, Madison). *J. Mol. Biol.;* **103**: 77-88(1976).

Each of the two largest brome mosaic virus RNAs, RNA1 and RNA2, directs the synthesis of a large protein in cell-free extracts derived from wheat embryo. The size of each protein represents the translation of almost the entire length of the corresponding RNA. It was shown previously that brome mosaic virus RNA4 directs the synthesis of the coat protein and that brome mosaic virus RNA3, although it also contains the coat protein cistron, is translated mostly into a single product unrelated to the coat protein (Shih and Kaesberg, 1973). Thus, the brome mosaic virus genome encodes a total of four proteins.

**22232 Structure of human serum lipoproteins in solution. II. Small-angle x-ray scattering study of $HDL_3$ and LDL.** Tardieu, A. (Centre de Genetigne Moleculaire, C.N.R.S., Gif-sur-yvette, France); Mateu, L.; Sardet, C.; Weiss, B.; Luzzati, V.; Aggerbeck L.; Scanu, A.M. *J. Mol. Biol.;* **101**: 129-153(1976).

Two human serum lipoprotein particles, $HDL_3$ and LDL, were studied in solution in solvents of variable density (NaBr in water) by small-angle X-ray scattering using a position-sensitive proportional counter. The structures of the particles were found to be independent of the salt concentration of the solution (i.e., the particles are impenetrable to NaBr). Density heterogeneities are negligible and size and shape heterogeneities appear to be small. The results are compatible with the shape of the particle being compact and quasi-spherical although with deeply convoluted surfaces. They also indicate that the outer layers of the particles are occupied by the proteins and the polar groups of phospholipids and free cholesterol, and the cores by neutral lipids. The maximum diameters of the particles are 130A and 280A for $HDL_3$ and LDL, respectively, while the hydrocarbon cores have diameters of 80A and 230A, respectively. The solvent is considered to penetrate to 25A from the center of the $HDL_3$ particle with a minimum solvation at a radius of 45A. In the case of LDL, the solvent penetrates to 55A from the center of the particle. The lipids in the cores of the particles, particularly the cholesterol esters, appear to display a micelle-like organization with the steroid nuclei segregated in regions distinct from those occupied by the hydrocarbon chains.

### TRACER TECHNIQUES

*REFER ALSO TO CITATION(S) 22272*

## CYTOLOGY

**22233** (LBL—5638) **View on techniques of preparation of cell and tissue culture specimens for electron microscopy.** Johnson, J.E. Jr. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). May 1977. Contract W-7405-ENG-48. 17p. Dep. NTIS, PC A02/MF A01.

Many investigators fix and embed cell cultures in situ for electron microscopy. Maximum structural integrity is maintained, and cell-to-cell contacts are easily studied. Coating coverslips with evaporated carbon is a popular method for allowing easy separation of polymerized blocks from the coverslips. Because carbon coatings are hydrophobic, we have developed a new method whereby the carbon coating is overlaid with evaporated silicon monoxide, providing a surface that wets easily and still allows separation of polymerized blocks from the coverslip. Our complete technique for coating coverslips, fixation, dehydration, and embedding is described.

**22234** (LA-tr—77-88) **Impulse cytophotometric studies on tumor material.** Krug, H. Translated from *Arch. Geschwulstforsch.;* **46**: No. 2, 110-115(1977). 10p. NTIS, MF A01.

Portions of document are illegible.

By impulse cytophotometry (ICP) we can get the distribution of the frequency of cell nuclei as a function of the fluorescence intensity. The interpretation of the curves is only possible on the basis of histophysical and histochemical features. The following problems are discussed: specificity of staining with ethidium bromide, pretreatment, detritus, comparison with other independent methods. The second peak of the karyogram consists of $G_2$-cells and in polyploidy of tetraploid cells. This peak is often high in cell suspensions of malignant tumours; sometimes we found polyploidy

up to 16c. The stem line concept is discussed. The ICP is a valuable aid in exfoliative cytology, but no screening method.

**22235** (LA-tr—77-87) **Impulse cytophotometric and repeated cytologic examinations of cervical secretions as compared with histologic findings.** Krug, H.; Kuhndel, K.; Ebeling, K. Translated from *Arch. Geschwulstforsch.;* **46**: No. 4, 294-303(1977). 18p. NTIS, MF A01.

Portions of document are illegible.

1625 cervical smears from 397 women were investigated in special cytological consultations. On the same material 693 impulse cytophotometric (ICP) measurements were made, stained with ethidium bromide after pepsination. In 297 patients the diagnosis was certain by histology. The mean height of the 4c-peak (in ‰ of the 2c-peak) rises with the Papanicolaou grading from 38.2 in Pap. I up to 128.8 in Pap. V. In histological confirmed cases in dysplasia the mean 4c-height was 79.5 and in carcinoma 102.2. If only one ICP investigation was turned to account there are some disagreements between the ICP value and the diagnosis finally resulting from the clinical and cytological course. The differences are considerably diminished by repeated ICP investigations. Therefore ICP measurements are a valuable aid in interpreting cytodiagnostic problems. They often facilitate the choice of further diagnostic and therapeutic procedures.

**22236** (LA-tr—77-94) **Characterization of malignant ovarian tumors by impulse cytophotometry.** Krug, H.; Ebeling, K. Translated from *Arch. Geschwulstforsch.;* **46**: No. 3, 214-224(1977). 18p. NTIS, MF A01.

Portions of document are illegible.

31 malignant adnexal tumors were investigated by impulse cytophotometry. From the DNS distribution curves we interpreted the positions and the height of the peaks in order to get information about ploidy and proliferation pattern. 45.2% were classified into the diploid, 29.0% into the polyploid and 12.9% into the tetraploid group. 12.9% were aneuploid. Comparing our results with chromosome analyses in the literature we found more tetraploid tumors in our material. For our polyploid curves we assume that many of the cells in the 8c-peak remain in the corresponding $G_2'$-Phase, not undergoing mitosis.

**22237** (LA-tr—77-86) **Continuous-flow fluorometry of ovarian carcinoma with and without effusions.** Krug, H.; Ebeling, K. Translated from *Zentralbl. Gynaekol.;* **98**: No. 7, 410-417(1976). 13p. NTIS, MF A01.

Portions of document are illegible.

By flow microfluorometry the DNA distribution curve of the cell nuclei of 39 adaex tumors, mainly ovarian carcinomas, was measured. 47% of the malignant tumor cell populations were diploid, the other ones were heteroploid (i.e., polyploid, tetraploid, aneuploid stem lines). Heteroploid tumors had the worse prognosis. In 8 cases effusions were analysed (7 ascites, 1 pleura). It is possible to diagnose a malignant tumor from effusion fluid by impulse cytophotometry. But in one case a great difference was found between the primary tumor and the ascites fluid, which only shows the DNA distribution of an irritative effusion. The value of impulse cytophotometry for clinical purposes is discussed.

## GENETICS

**22238** (COO—3267-15) **Improved mutagen-testing systems in mice. Progress report, 1 June 1976—31 August 1977.** Roderick, T.H. (Jackson Lab., Bar Harbor, Maine (USA)). 12 Oct 1977. Contract EY-76-S-02-3267. 17p. Dep. NTIS, PC A02/MF A01.

Results are reported from studies on the production of chromosomal inversion by chemical treatment or irradiation of sperm in mice and to detect inversions by observing high frequencies of first meiotic anaphase bridges of their sons or by using chromosomal banding techniques to detect inverted segments cytologically. For each new inversion, which is either of considerable length or which has particularly useful experimental properties, we will determine its linkage group, mark it genetically, if possible, or place it with a genetically marked homologous chromosome, and study its cytological, physiological, and anatomical effects. The inversions are being used to construct recessive lethal testing systems for estimating mutational loads in populations exposed to radiation or either proved or potential chemical mutagens, to mark and maintain induced lethals for analysis of their potential dominant effects on fitness, and to study other basic problems in mammalian genetics.

**22239** (RLO/2225/T5—35) **Average number of generations until extinction and rate of allelism of lethal genes in a sub-divided population.** Yokoyama, S. (Washington Univ., Seattle (USA). Dept. of Genetics). 1974. Contract EY-76-S-06-2225-005. 29p. Dep. NTIS, PC A03/MF A01.

The expected number of generations until extinction of a lethal gene was studied by a Markov chain method for two partially isolated populations of Drosophila whose sizes are $N_1$ and $N_2$. A simulation study was done for larger population sizes. The extinction time depends strongly on the asymmetry of $N_1$ and $N_2$, the size of the population in which the new lethal mutant arises, and the number of migrants per generation. If $N_1 < N_2$ and if the mutant appears in the larger population, then the extinction time of the lethal gene is always shorter than in a single random mating population of size $N_1 + N_2$. When the mutant appears in the smaller population the extinction time increases as the number of migrants increases. Compared to a single population of size $N_1 + N_2$, the extinction time is shorter if migration is extremely restricted; however, it is much longer if the number of migrants is large.

## METABOLISM

*REFER ALSO TO CITATION(S) 22275*

**22240** **Sphaerococcenol A: a new rearranged bromo-diterpene from the red alga Sphaerococcus coronopifolius.** Fenical, W. (Scripps Inst. of Oceanography, La Jolla, CA); Finer, J.; Clardy, J. *Tetrahedron Lett.;* No. 10, 731-734(1976).

Biosynthesis involving bromination mechanisms is now recognized as a characteristic of at least nine families of the red seaweeds (Rhodophyta). While bromine-containing diterpenes are not common among these algae, examples of two ring systems, concinndiol and iriediol, are elaborated only by Laurencia species. The structure of a new bromo-diterpene obtained from extracts of the red seaweed Sphaerococcus coronopifolius is reported. This metabolite appears to result from a methyl migration of a tail to tail diterpene precursor or from more substantial molecular rearrangements.

## MEDICINE

*REFER ALSO TO CITATION(S) 22131, 22250*

### TRACER TECHNIQUES

*REFER ALSO TO CITATION(S) 22123, 22124*

**22241** **Nuclear medicine 1977: an assessment.** Hattner, R.S. (Univ. of California, San Francisco). *Trans. Am. Nucl. Soc.;* **27**: 165(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22242** **Blood flow imaging with nuclear magnetic resonance.** Singer, J.R.; Libove, J. (Univ. of California, Berkeley). *Trans. Am. Nucl. Soc.;* **27**: 165-166(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22243** **Alternative displays in nuclear medicine.** Goris, M.L. (Stanford Univ., CA). *Trans. Am. Nucl. Soc.;* **27**: 166-167(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22244** **Quantitation of the degree of osteoporosis by measure of total-body calcium employing neutron activation.** Cohn, S.H.; Zanzi, I.; Vaswani, A.; Wallach, S.; Aloia, J.; Ellis, K.J. (Brookhaven National Lab., Upton, N.Y. (USA). Medical Research Center). *Calcif. Tissue Res.;* **21**: 375-379(Aug 1976).

In the present study, two techniques for measuring the amount of Ca in the total skeleton were employed: Total-Body Neutron Activation Analysis (TBNAA) and the determination of the mineral content of a bone of the appendicular skeleton (absorptiometric measurement of the radius). The degree of osteoporosis in an individual can be assessed in terms of their calcium deficit, as measured by TBNAA, but only on a statistical basis.

## PATHOLOGY

**22245** **Discrepancy in XC and oncogenicity assays for murine leukemia virus in AKR mice.** Hays, E.F.; Vredevoe, D.L. (Univ. of California, Los Angeles). *Cancer Res.;* **37**: 726-730(Mar 1977).

Studies of murine leukemia virus expression in AKR mice are presented. Material from in vivo and in vitro sources of normal tissues and lymphomas was assayed for in vitro infectivity, using the

XC plaque assay, and for oncogenicity, by assessing lymphoma-accelerating capacity after inoculatin into newborn animals. These findings are interpreted as showing the presence of two viruses in AKR mice. One is XC positive and present throughout life. The other is oncogenic, appears later in life, and could be a separate virus or a variant of the first one.

**22246 Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California.** Robertson, T.L. (Environmental Protection Agency, Research Triangle Park, NC); Kato, H.; Rhoads, G.G. *Am. J. Cardiol.;* **39**: 239-243(Feb 1977).

The incidence of myocardial infarction and death from coronary heart disease was studied in defined samples of 45 to 68 year old Japanese men in Japan, Hawaii, and California. The incidence rate was lowest in Japan where it was half that observed in Hawaii ($P < 0.01$). The youngest men in the sample in Japan were at particularly low risk. The incidence among Japanese men in California was nearly 50% greater than that of Japanese in Hawaii ($P < 0.05$). A striking increase in the incidence of myocardial infarction appears to have occurred in the Japanese who migrated to the United States; this increase is more pronounced in California than in Hawaii.

**22247 Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California.** Robertson, T.L. (Environmental Protection Agency, Research Triangle Park, NC); Kato, H.; Gordon, T. *Am. J. Cardiol.;* **39**: 244-249(Feb 1977).

Various risk factors were evaluated to explain a significantly greater incidence of coronary heart disease in men of Japanese ancestry resident in Hawaii compared with men resident in Japan. The independent predictors of incidence of coronary heart disease in both Japan and Hawaii were systolic blood pressure, serum cholesterol, relative weight, and age. These factors appeared to influence incidence similarly in both areas because in each case the correlation coefficients for Japan and Hawaii did not differ significantly. The hypothesis that the greater incidence in Hawaii could be attributed to differences in levels of these risk factors was tested with the Walker-Duncan method. The four variable multiple logistic function describing the probability of coronary heart disease in Japan was applied to the cohort characteristics observed in Hawaii. The estimated incidence thus obtained was not significantly different from that actually observed in the men resident in Hawaii. Therefore the increased coronary risk profile in Hawaii compared with Japan can account for the greater incidence of coronary heart disease in the former. Current cigarette smoking was significantly related to the risk of coronary heart disease in Hawaii but not in Japan. This difference requires further investigation.

## PHYSIOLOGICAL SYSTEMS

**22248 Relative roles of conduction and convection in the body temperature change of gizzard shad, Dorosoma cepedianum.** Beitinger, T.L.; Thommes, M.M.; Spigarelli, S.A. (Argonne National Lab., IL). *Comp. Biochem. Physiol., A;* **57**: 275-279(1977).

The intestinal temperatures of 22 gizzard shad subjected to instantaneous $\Delta T$'s of +-9.5°C were monitored while fish were alive and dead. A significant relationship between fish body weight and coefficient of rate of body temperature change was demonstrated by double logarithmic correlation of these variables. The slope (= exponent) relating fish body weight and temperature change equalled 0.64 for live and 0.66 for dead shad. Consistent with results for other fishes, a significant number of live shad heated more rapidly than they cooled. Comparisons of data for live and dead fish indicated that conduction accounted for 80% and therefore convection 20% of the total heat transfer in these experiments.

### TRACER TECHNIQUES

*REFER ALSO TO CITATION(S) 22268*

## PUBLIC HEALTH

*REFER ALSO TO CITATION(S) 22246, 22247*

## AGRICULTURE AND FOOD TECHNOLOGY

*REFER ALSO TO CITATION(S) 21698, 21699, 21700, 21716, 21718, 21719, 21724, 21749*

**22249** (UCRL—13782) **Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton.** Thompson, C.R.; Kats, G. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). 6 Oct 1977. Contract W-7405-ENG-48. 17p. Dep. NTIS, PC A02/MF A01.

These results show that continuous fumigation of lettuce with 30 ppB $H_2S$ which is well fertilized with sulfate can stimulate growth very significantly. The environmental factors which enhance or reduce this effect are not known. Three hundred ppB $H_2S$ causes reduced growth. The addition of 50 ppM $CO_2$ to the plant atmospheres which receive 300 ppB $H_2S$ counteracts part of the growth reduction caused by $H_2S$. Lettuce accumulates sulfur in relation to the amount in the atmosphere. Fumigation of sugar beets with 30 ppB $H_2S$ causes pronounced growth stimulation, and has no effect on percent of sugar. A trend or a statistically valid stimulation is seen with 100 ppB depending on the experiment, and 300 ppB doesn't cause a significant growth reduction. Addition of 50 ppM $CO_2$ had no effect in reversing the effect of 300 ppB $H_2S$. Sulfur accumulated in leaves as it did with lettuce depending upon the amount in the atmosphere. Sugar beets are very tolerant to $H_2S$. Cotton shows a trend toward growth reduction with 300 ppB $H_2S$ but not a significant effect. The addition of 50 ppM $CO_2$ plus $H_2S$ causes a significant stimulation of growth as compared to plants receiving 300 ppB $H_2S$. The limited data show no additional accumulation of sulfur from the atmosphere. Alfalfa shows either growth reduction with 300 ppB $H_2S$ or no effect, depending upon the particular cutting. Likewise, the addition of 50 ppM $CO_2$ to plants receiving $H_2S$ either has a significant counteracting effect or no effect, depending upon the cutting. The environmental conditions which enhance or reduce these effects of $H_2S$ and $H_2S + CO_2$ are not apparent at present.

# BIOMEDICAL SCIENCES, APPLIED STUDIES

## RADIATION EFFECTS ON BIOCHEMICALS

### IN ANIMALS

**22250 Blood compatibility of radiation-grafted hydrogels.** Ratner, B.D. (Univ. of Washington, Seattle); Hoffman, A.S.; Whiffen, J.D. *Biomater., Med. Devices, Artif. Organs;* **3**: No. 1, 115-120(1975).

Radiation grafted hydrogels of poly(2-hydroxyethyl methacrylate) and poly(N-vinyl-2-pyrrolidone) on silicone rubber rings were evaluated by the standard vena cava ring implantation test. Both grafted hydrogel rings showed significant patency after 2 weeks implantation, in contrast to the untreated silicone rubber rings which were totally occluded after 2 hr.

## RADIATION EFFECTS ON CELLS

### EXTERNAL SOURCE

*REFER ALSO TO CITATION(S) 22261*

### INTERNAL SOURCE

**22251 Critical DNA damage and mammalian cell reproduction.** Burki, H.J. (Univ. of California, Berkeley). *J. Mol. Biol.;* **103**: 599-610(1976).

Synchronous Chinese hamster cells accumulated $^{125}I$-induced DNA damage in the $G_2$ + M period at 4°C. The position of the $^{125}I$ within the nuclear DNA was varied by incorporating [$^{125}I$]iododeoxyuridine at various times during the previous DNA replication period. When the initial cell inactivation efficiency was compared for damage accumulated in various regions of nuclear DNA, it was found that the efficiency of inactivation was least in early replicating DNA, and that it gradually increased, reaching a maximum during the fourth and fifth hours of the six-hour DNA replication period. Because the DNA that replicated during this maximum corresponds to that DNA which later forms centromeric and near-centromeric regions of the chromosomes, damage in centromeric region DNA may be critical in causing mammalian cell inactivation.

## RADIATION EFFECTS ON MICROORGANISMS

### BASIC STUDIES

**22252** (COO—2362-27) **Basic aspects of radiation action on microorganisms. Final report for the period ending October 31, 1977.** Pollard, E.C. (Pennsylvania State Univ., University Park (USA). Dept. of Biochemistry and Biophysics). Dec 1977. Contract EY-76-S-02-2362. 12p. Dep. NTIS, PC A02/MF A01.

Progress is reported on studies on the basic aspects of radiation effects on microorganisms. Results are included from studies

on the effects of uv pretreatment on the survival of γ-irradiated micrococcus luteus and uv-induced radioresistance to bacteriophage.

## RADIATION EFFECTS ON PLANTS

### BASIC STUDIES

**22253** (LA-tr—77-75) **Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems.** Baarli, J.; Bianchi, M.; Keusch, F.; Mindek, G.; Sullivan, A.H. (European Organization for Nuclear Research, Geneva (Switzerland); Zurich Univ. (Switzerland)). 1977. Translation of A—73.01.1. 5p. Dep. NTIS, PC A02/MF A01.

As an introduction to preclinical studies, pilot studies of pion beams are planned with relatively simple biological model systems that can be quickly evaluated and that yield indicative data for further action. Inhibition of growth was studied in Vicia faba roots, a biological system excellently suited for RBE and OER studies. For comparison there are already results from a low-intensity pion irradiation. A second system used Drosophila embryos 1 and 4 hours old, which are especially well suited for LET studies. The unambiguous criterion will be failure to slip out of the oolemma. The smallness of the objects (their beam sensitivity) will make it possible to determine empirically the peak region and to determine Gain factors; furthermore, the known dependency of RBE on the development stage promises highly informative results.

## RADIATION EFFECTS ON ANIMALS

### MAN

*REFER ALSO TO CITATION(S) 20935, 21217, 22194, 22195, 22208, 22281*

**22254** **Cancer induction by alpha emitting warm particles.** Martell, E.A. (National Center for Atmospheric Research, Boulder, CO). *Trans. Am. Nucl. Soc.;* **27**: 125(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22255** **Estimate of early mortality and morbidity following acute inhalation of plutonium.** Goldman, M.; Raabe, O.G. (Univ. of California, Davis). *Trans. Am. Nucl. Soc.;* **27**: 125-126(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22256** **Exposure to radon daughters and the incidence of lung cancer.** Ellett, W.H. (U.S. Environmental Protection Agency, Montgomery, AL). *Trans. Am. Nucl. Soc.;* **27**: 148-149(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22257** **Safety training as a means of reducing overexposures to radiographers.** Hanley, D.W.; Martin, J.G. (Univ. of Lowell, MA). *Trans. Am. Nucl. Soc.;* **27**: 209(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22258** **Some problems in radiation exposure of pregnant women.** Tabuchi, A. (Otake National Hospital, Hiroshima); Hirai, G.; Saito, J.; Katsube, Y.; Sato, H.; Matsuda, M.; Yano, K.; Kosaka, T. *Hiroshima J. Med. Sci.;* **24**: No. 4, 213-228(Dec 1975).

Data on present status of exposure of pregnant women to radiation; estimate of risk by low dose exposure; causes of congenital anomalies; precautions at the time of prenatal radiography; and future prospects of mankind are summarized.

**22259** **Search for radioprotective agents. Part XXXIX. Synethesis of some sulfenamides.** Tulecki, J.; Skwarski, D.; Musial, E.M.; Otta, H. (Inst. of Chemistry and Analytics, Medical Academy, Poznan, Pol.). *Pol. J. Pharmacol. Pharm.;* **27**: No. 4, 451-453(1975).

4-(2'-, 4'-nitro- and 2',4'-dinitrobenzenesulfenamido)-quinaldines (I—III) as well as 2-(2'-,3'-nitro and 2',4'-dinitrobenzenesulfenamido)-4,6-dimethylpyrimidines (IV—VI) were obtained. These compounds show a very weak radioprotective activity.

**22260** (ORNL-tr—4547) **General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants.** Snihs, J.O. (Statens Straalskyddsinstitut, Stockholm (Sweden)). [nd]. Translation by J. Brynestad of Swedish report. 3p. Dep. NTIS, PC A02/MF A01.

Radiation dose limits for personnel of nuclear power plants in Sweden are reported to be well below the acceptable dose limit of 5 rem/yr during normal operations. It is estimated that approximately one-half of the job-related radiation dose occurs during equipment inspection. The added costs of good radiation protection measures during construction to assure easy accessibility and ease of handling instruments and systems and for limiting release of radioactive effluents are considered from safety and public relations viewpoints.

### VERTEBRATES

*REFER ALSO TO CITATION(S) 22238*

**22261** (LA-tr—77-73A) **Analysis of animal experiments of radiation dependent tumor regression in relation to different parameters.** Heinzel, F.; Mueller-Duysing, W.; Blattman, H.; Bacesa, L.; Rao, K.R.; Mindek, G. 1977. Translation of PK-AN—71-2. 9p. Dep. NTIS, PC A02/MF A01.

In order to be able to test the therapeutic value of the pions in comparison with conventional X-rays, analyses of animal experiments with induced tumors, transplantation tumors, and comparative cellular kinetic studies of tissue cultures will be performed. So that differences in radiation effect and a possible superiority of the pion therapy be objectively acknowledged, the reaction systems to be tested must be as homogenous as possible. For this purpose, the dependence of the radiation related regression on various parameters such as sex, age of hosts, environmental factors radiation conditions (intensity, fractionation, and so on), tumor size, and so on, must be investigated on sterile animals in a sterile environment. The experiments should be conducted under conditions as close as possible to clinical ones. For comparison, the reaction of normal tissue (in vitro and in vivo) and of malignant cells in short-time tissue cultures will be analysed. Cellular kinetics, alteration of chromosomes and metabolic activity of the cells will be studied.

**22262** (LA-tr—77-67) **Effect of pions on germ cells and occurrence of mutations.** Baarli, J.; Bianchi, M.; Fritz-Niggli, H.; Michel, C.; Suda, T.; Sullivan, A.H.; Suter, K. (European Organization for Nuclear Research, Geneva (Switzerland); Zurich Univ. (Switzerland)). 1977. Translation of A—73.02.1. 10p. Dep. NTIS, PC A02/MF A01.

Both as a source of fundamental knowledge as to suitability of pions for cancer therapy and in the interests of radiological protection, analyses of injury to genetic material and to germ cells as a function of pion radiation depth are of great value. Test systems have been provided which were previously carefully studied and which provided to be especially adapted to comparable researches with radiation of diverse kinds. Survival of especially radiation susceptible mammalian cells (Spermatogonia Type B) in mouse gonads and mutations in Drosophila after exposure to negative and positive pions were investigated. Findings of the experimenters with these systems after radiation with pions of lesser intensity and 14 as well as 400 MeV neutrons are available for comparison.

**22263** (LA-tr—77-77B) **Effect of pions on the embryonal development of the mouse.** Blattman, H.; Cordt-Riele, I.; Fritz-Niggli, H.; Hett, W.; Michel, C. (Zurich Univ. (Switzerland)). May 1976. Translation of BM—71-02.3. 4p. Dep. NTIS, PC A02/MF A01.

It is of great interest to perform in vivo investigations for preclinical experiments of the effects on pions not only on malignant but also on healthy cells and organs. Mouse embryos at the organogenetic stage are particularly well suited for this. Not only are they very sensitive to radiation (adequate to the present intensity of our biomedical radiation) but also particularly sensitive to LET-differences. Analyses of RBE at different points (plateau-peaks) of the ray profile, high- and low LET-radiation as well as tests with possible sensibilisators of the radiation effect with the intent to an amelioration of the cancer therapy will be considered.

### INVERTEBRATES

*REFER ALSO TO CITATION(S) 22253, 22262*

### PEST CONTROL

**22264** (COO—38-1838) **Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967—September 1977.** Rai, K.S. (Notre Dame Univ., Ind. (USA). Radiation Lab.). 1977. Contract EY-76-C-02-0038. 9p. Dep. NTIS, PC A02/MF A01.

The major objectives of the project on Aedes aegypti, which is one of the most important disease vectors of man, were to study the cytogenetic effects of radiation and certain chemical mutagens,

the genetics of radiation-induced chromosomal rearrangements with particular attention to reciprocal translocations, and the possibility of using translocations for genetic control of natural populations. Results reported on work done during the years 1967 and 1977 show these objectives have been mostly accomplished.

**MAN**

*REFER ALSO TO CITATION(S) 22163, 22164, 22172, 22189, 22225*

## NUCLIDE KINETICS AND TOXICOLOGY

**MAN**

*REFER ALSO TO CITATION(S) 22181, 22207, 22221, 22254, 22260*

**22265** (HASL—325, pp 102-104) **Recent advances in understanding the risk due to the inhalation of radon daughters.** Ellett, W.H. Jul 1977.

From Radon workshop; New York, NY, USA (Feb 1977). In Radon workshop, February 1977.

Many of the estimates of the cancer risk due to radon daughter inhalation, made on the basis of epidemiological data available in the late 1960's, are becoming obsolete. Also, as might be expected, these earlier estimates appear to be somewhat low. Exposed persons have continued to die as the length of the followup period has continued. The 1972 BEIR Report updated and detailed results published in Joint Monograph No. 1, Radon Daughter Exposure and Respiratory Cancer by Lundin, Wagoner and Archer. As in all BEIR estimates, the risk of lung cancer was assessed in two ways, absolute risk, or the number of excess cancers expected per $10^6$ organ rem per year at risk and relative risk, and the proportion of excess cancer incidence observed per rem compared to the incidence in an unexposed control population. For the case of U.S. uranium miners, the absolute risk estimated in 1972 was 1 excess lung cancer per $10^6$ organ rem per year at risk. Archer and others have monitored uranium miner deaths since the BEIR Report was prepared and also re-examined criteria for accepting some of the death data previously used. This has led to revised conclusions. The most recently published estimate of the risk to U.S. uranium miners was published in the 1976 NAS report, Health Effects of Alpha-Emitting Particles in the Respiratory Tract, prepared by a BEIR ad hoc committee to investigate the hot particle problem. The conclusion reached in this report is that the previous BEIR estimate was low by a factor of two and that a better estimate of the absolute risk is two lung cancers per $10^6$ organ rem per year at risk. Other recent studies using non U.S. data are reviewed that also appear to support a higher risk due to radon daughter inhalation.

**22266** **Relative occupational risks of plutonium and $^{233}U$ fuels.** Langer, S. (General Atomic Co., San Diego, CA); Lawroski, H. *Trans. Am. Nucl. Soc.;* **27**: 130-131(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22267** (ORNL-tr—4526) **Experimental study of the penetration of radioactive aerosols into the respiratory tract.** Duport, P.; Madelaine, G.; Zetwood, P.; Renoux, A. Translated from *Chemosphere;* **6**: No. 1, 35-40(1977). 12p. Dep. NTIS, PC A02/MF A01.

The protection of uranium miners against radiation requires, in addition to the knowledge of certain purely physical parameters of the air in the mine (particle size of the aerosols, radioactive or not, state of electrical charge, free fraction, etc.), some knowledge of the degree of penetration and retention of the radioactive aerosols in the respiratory tract. A new biological model was developed and results compared with an experimental study in rats. The level of retention was calculated separately for the different parts of the respiratory tract: the nasopharynx (NP), the tracheobronchial region (TB), and the lung (L). The results of this model for calculating the radiation dose to each of the three regions of the respiratory tract are compared with autoradiographic studies of radiation dose distributions in rats.

**ANIMALS**

*REFER ALSO TO CITATION(S) 22267*

**22268** (COO—2363-4) **Placental transport of radionuclides. Terminal report, May 1, 1973—July 31, 1975.** Kronfeld, D.S. (Pennsylvania Univ., Philadelphia (USA)). Aug 1977. Contract EY-76-S-02-2363. 9p. Dep. NTIS, PC A02/MF A01.

Four successful experiments were conducted with tritiated water on pregnant sheep. This came into equilibrium between fetal and maternal circulations within 60 seconds after injection into the ewe or the fetus. The estimates of total water transport rate averaged 85% of the daily water intake. Six successful experiments were conducted with $^{3}H$- and $^{14}C$-glucose on pregnant ewes. The results for glucose space and transport rate in the ewes agree closely with previously published data. The fetal glucose pool size was large, presumably reflecting the relatively large volume of fetal-placental fluids in exchange with fetal blood. Six successful experiments were conducted with $^{45}Ca$ and $^{47}Ca$ for 5 days or more on pregnant ewes. The smallest compartment size of exchangeable calcium in mother and fetus were about 2 to 6 hours duration, and the net daily gain of calcium by the fetus was just slightly less in the chronic than in the acute experiments, 0.75 and 0.83 g/day respectively.

**PLANTS**

*REFER ALSO TO CITATION(S) 22201*

**MICROORGANISMS**

*REFER ALSO TO CITATION(S) 22228*

## CHEMICALS METABOLISM AND TOXICITY

*REFER ALSO TO CITATION(S) 21020, 21052, 21053*

**22269** (CONF-730386—, pp 741-781) **Study of the effects of the San Francisco oil spill on marine organisms.** Chan, G.L. (Coll. of Marin, Kentfield, CA). 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

The San Francisco oil spill occurred on January 18, 1971, during the early morning hours when two Standard Oil vessels collided almost directly under the Golden Gate Bridge, releasing 840,000 gallons of Bunker C fuel. This asphalt-like oil was washed up on intertidal shores of the area. From comparative transect and laboratory observations, it was determined that marine organisms died from being smothered by the oil, with certain species, such as acorn barnacles and limpets, suffering the highest mortality at Sausalito and on Duxbury Reef. Comparison of pre-oil and post-oil transect counts showed there was a significant decrease in marine life after the oil spill on the reef. Marine snails suffered less mortality than the sessile barnacles and other sedentary animals. The normally large population of striped shore crabs is missing from the rocky crevices. Finally, marine algal blooms were also observed in certain reef localities.

**22270** (CONF-730386—, pp 793-808) **Interagency investigations of a persistent oil spill on the Washington Coast.** Clark, R.C. Jr. (National Marine Fisheries Service, Seattle); Finley, J.S.; Patten, B.G.; Stefani, D.F.; DeNike, E.E. 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

An interagency team of biologists, chemists, oceanographers and engineers has been investigating the long-term effects of oil spilled by the grounding of the troopship GENERAL M.C. MEIGS January 6, 1972, on an ocean coast intertidal community of plants and animals. Oil has continuously been released from the 440,000 liters of Navy Special Fuel Oil carried by the vessel. The team assessed biological damage by making (1) surveys of abundance and physiological condition of animals, (2) qualitative evaluation of obvious damage to plants, and (3) measurements of the hydrocarbon uptake in both plants and animals. A series of sites, forming a vertical profile of the rocky shelf area from the upper intertidal zone to the lowest low tide level in Wreck Cove, have been studied. This report describes the preliminary findings of the first ten months (January-October, 1972) of the investigation. Abnormal and dead urchins (Strongylocentrotus purpuratus) indicated that this species was affected. Loss of fronds and bleached thalli not evident in control areas were observed in the plant community in the immediate vicinity of the hulk. Petroleum hydrocarbons were taken up in the intertidal community. The normal paraffin hydrocarbon patterns and content over the range n-$C_{14}H_{30}$ to n-$C_{37}H_{76}$ of healthy-appearing goose barnacles (Mitella polymerus), crabs (Hemigrapsus nudus) and an alga (Fucus gardneri) display the same basic characteristics as the fuel oil which had been lost from the GENERAL M.C. MEIGS.

**22271** (CONF-730386—, pp 809-813) **Effects of water soluble extracts of oil on phytoplankton.** Nuzzi, R. (New York Ocean Science Lab., Montauk). 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

Methods routinely employed in the cleanup of oil spills generally are intended to remove the oil to the level of invisibility, at which point it has been considered by many to be harmless or its effects negligible. This paper presents evidence indicating that soluble constituents of No. 2 fuel oil are toxic to phytoplankton cultured axenically and also exert an effect on natural phytoplankton populations.

## CELLS

**22272 Stimulation of informosomal RNA synthesis in cultured Chinese hamster cells exposed to low levels of cadmium.** Enger, M.D.; Campbell, E.W.; Barrington, H.L. (Los Alamos Scientific Lab., NM). *FEBS (Fed. Eur. Biochem. Soc.) Lett.;* 70: No. 1, 43-47(Nov 1976).

In an attempt to determine whether there is any specificity in cadmium stimulation of RNA or protein synthesis, the appearance of messenger RNA into cytoplasmic ribosome-bound or free nucleoprotein forms was followed. The RNAs of these RNPs were selectively labelled with radioactive nucleoside precursors in the presence of a low concentration of actinomycin. The results indicate that in cadmium-treated cultures, messenger and messenger-like RNA incorporation is stimulated, with a greated stimulation of incorporation into informosomal species relative to polysome-bound species. Regardless of mechanism, the author concluded that a relatively low level of cadmium, one which does not affect growth, can alter RNA metabolism in CHO cells to a significant extent even to modify cell development nature and possibly provide a basis for the know teratogenic effects of sublethal doses of cadmium in hamsters. (PCS)

## MICROORGANISMS

**22273** (CONF-730386—, pp 815-819) **Effect of a bunker fuel on the beach bacterial flora.** Cobet, A.B.; Guard, H.E. (Univ. of California, Berkeley). 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

Studies at four sampling locations on three beaches in the San Francisco area affected by oil from an 840,000 gallon spill of Chevron bunker fuel have shown that the size of the bacterial population and distribution of bacterial genera within the beach was unaffected by the petroleum hydrocarbons remaining in the beach sand after completion of the cleanup operation. Only 15 percent of the beach bacteria were affected by a variety of petroleum components including the pentane soluble fraction of the bunker fuel.

**22274** (CONF-730386—, pp 821-825) **Microbial petroleum degradation: the role of cladosporium resinae.** Walker, J.D.; Cofone, L. Jr.; Cooney, J.J. (Univ. of Dayton, OH). 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

Cladosporium resinae is probably the most prevalent hydrocarbon-utilizing fungus. It has been isolated in fresh water and marine environments. It utilizes aliphatic and aromatic hydrocarbons, as well as alcohols and acids. Growth on aliphatic hydrocarbons is slow, and yields are lower than for cells cultured on acids. However, degradation of hydrocarbons is not slow, since most of the hydrocarbon is mineralized (converted to $CO_2$) and not assimilated to cellular carbon. Growth of the fungus was not supported by organo-phosphorus, chlorinated hydrocarbon, or natural pesticides as sole carbon source. However, the fungus was resistant to or stimulated by high concentrations (20,000 ppM) of these pesticides when cultured on hydrocarbons. This suggests that high concentrations of pesticides occurring in oil slicks would not inhibit oil degradation by Cladosporium resinae. Hydrocarbon-oxidation is constitutive in Cladosporium resinae. Cells oxidize aldehydes, although they did not grow on them. Isolation of intermediates and results of experiments utilizing electron transport inhibitors support the conclusion that in C. resinae alkanes are oxidized to their homologous alcohol, aldehyde and acid. The range of hydrocarbon substrates degraded by constitutive enzymes of Cladosporium resinae coupled with the ability to degrade hydrocarbons in the presence of high concentrations of pesticides suggests that C. resinae may be one of the most important microorganisms capable of degrading oil in the natural environment.

## PLANTS

*REFER ALSO TO CITATION(S) 22148*

## INVERTEBRATES

*REFER ALSO TO CITATION(S) 22148*

## VERTEBRATES

*REFER ALSO TO CITATION(S) 22148, 22219, 22238*

**22275** (CONF-730386—, pp 783-791) **Respiratory response of juvenile chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil.** Brocksen, R.W.; Bailey, H.T. (Tiburon Fisheries Lab., CA). 1973.

From Conference on the prevention and control of oil spills; Washington, DC, USA (13 Mar 1973).

In Proceedings of joint conference on prevention and control of oil spills.

Interest surrounding the potential effects of crude oil on aquatic organisms has increased in recent years due to the incidence of accidental oil spills. There are few experimental results reported, however, dealing with the effect on aquatic species of water-soluble aromatic hydrocarbons contained in crude oil. Such compounds are highly toxic to mammals. Experiments were conducted using juvenile chinook salmon, Oncorhynchus tshawytscha, and striped bass, Morone saxatilis. The fish were exposed to sub-lethal concentrations of the aromatic hydrocarbon benzene, for periods ranging from 1-96 hours. Prior to exposure, and after exposure to the benzene, respiration rates of individual fish were measured. Results show increases in respiratory rate up to 115 percent above that of control fish after exposure periods of 24 hours for striped bass and 48 hours for chinook salmon. Fish exposed to benzene concentrations of 10 ppM for periods longer than those listed exhibit a narcosis that caused a decrease in respiratory rate. The narcotic state induced by exposure to benzene was shown to be reversible when the fish were placed in fresh water and kept for periods longer than 6 days. Possible biochemical mechanisms leading to this response are hypothesized.

**22276** (EML—334, pp I.69-I.90) **Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis.** Heit, M. 1 Jan 1978.

In Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977.

Seventeen elements, which can possibly enter the environment through the combustion of fossil fuels, were measured in the dorsal muscle and large and small liver lobes of a gravid female striped bass. Four of these elements, Be, Ga, Sb, and Tl were either not detected or, as is the case for Ag, occur at such low levels in the tissues that they may be eliminated from analysis in future fish bioaccumulation studies by our Laboratory. Concentration ratios were determined for the striped bass and comparisons were made where possible with the trace element concentrations reported in the muscle and liver of other marine and fresh water fish. The elements Ag, As, Cd, Cu, Hg, Pb, Se, Te, and Zn were significantly higher ($p \leq 0.10$) in concentration in the liver than in the muscle. Only Cd, Hg, and Se were significantly higher ($p \leq 0.10$) in concentration in the larger lobe of the liver than in the smaller.

**22277 Pulmonary deposition, translocation and clearance of inhaled neutron-activated talc in hamsters.** Wehner, A.P.; Wilkerson, C.L.; Cannon, W.C.; Buschbom, R.L.; Tanner, T.M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). *Food Cosmet. Toxicol.;* 15: No. 3, 213-224(1977).

To determine pulmonary deposition, translocation and clearance of inhaled talc, 10-wk-old hamsters received a single 2-hr nose-only exposure to neutron activated talc. Over a period of 4 months, the hamsters were killed in groups of four. Lungs liver, kidneys, ovaries, skinned carcass and 2-day and 4-day excreta were collected for $\gamma$-ray analysis. The isotope $^{60}Co$ was used to calculate the quantity of talc in all samples; in addition, the isotope $^{46}Sc$ was used in a number of samples to check the validity of $^{60}Co$ as a tracer for talc. From 20 to 80 $\mu$g talc, an estimated 6 to 8% of the inhaled quantity, was deposited in the alveoli. The biological half-life of the talc deposited in the alveoli was 7 to 10 days. Alveolar clearance was essentially complete 4 months after exposure. No translocation of talc to liver, kidneys, ovaries or other parts of the body was found. Several hundred micrograms of talc were found in the fecal samples. Results of a leaching study to be described elsewhere suggest that the picogram quantities of $^{60}Co$ found in the urine probably represented leached $^{60}Co$ absorbed in the gastro-intestinal tract.

**22278 Differential toxicity of chloroform in the mouse.** Hill, R.N. (Pennsylvania State Univ., Hershey). *Ann. N.Y. Acad. Sci.;* 298: 170-176(1977).

From Conference on aquatic pollutants and biologic effects with emphasis on neoplasia; New York, NY, USA (27 Sep 1976). See CONF-7609167—.

This study helps to reaffirm that all individuals in a population do not respond similarly to environmental stimuli. Studies on

individual differences in chloroform toxicity in mice have been reviewed, and these reports indicate that inbred strain-related differences within a species may help to point out the types of variability in response that one might encounter in studies on a genetically heterogeneous organism, like man. Statistics like median lethal or toxic dose in randomly bred animals may only serve to conceal the genetic variability that may exist. Two genetic variations in chloroform toxicity were described. In one, animals more sensitive to chloroform-induced death were shown to be more susceptible to renal toxicity; in the other, sensitive animals were unable to repair damaged renal tubules. Many other examples of genetic variation in response to foreign compounds have been reported. An absolute sex-related difference in regard to kidney damage, but not liver damage, that occurs on chloroform administration has been reviewed. Androgens play an integral role in modulating the sex-related difference and, possibly, the strain-related difference in sensitivity to kidney damage. It is interesting that tumors have been produced in experimental animals after long-term exposure to chloroform in the same organs that are affected by single doses of chloroform: hepatic tumors have been produced in mice, and renal tubular tumors have been found in male rats. The effects of long-term, low-level exposure to chloroform in man are largely unknown. However, occupational exposures as low as 10 parts per million in air have resulted in derangements in liver function; in rats, repeated maternal exposures to 30 parts per million chloroform in air have resulted in fetal growth retardation. Both of these effects occurred at exposures lower than the present occupational standard for humans.

### MAN

*REFER ALSO TO CITATION(S) 22148*

**22279** (ORNL-tr—4551) **Migration of uranium from the environment into a human being.** Berdnikova, A.V. Translated by L. Kobylenski from *Faktory Vnesh. Sredy Ikh Znachenie Zdrov'ya Naseleniya;* No. 2, 135-137(1970). 3p. Dep. NTIS, PC A02/MF A01.

The aim of this work was to study the distribution of uranium in certain human organs with regard to its migration from the environment. The study area was a geographical area deficient in uranium. The following items were studied for their uranium content: certain organs from people who had died an accidental death and who, in the course of their lives, had not come in contact with uranium; daily urine samples of persons habitually residing in the area under study; rainwater from different times of the year, and commercial samples of edible products of an animal and vegetable nature. Results indicated that the quantity of uranium in the human body is directly related to its presence in the environment.

## OTHER ENVIRONMENTAL POLLUTANT EFFECTS

**22280** (AD-A—042515) **Biologic effects of electric and magnetic fields associated with proposed Project Seafarer.** (National Research Council, Washington, D.C. (USA). Committee on Biosphere Effects of Extremely-Low-Frequency Radiation). 1977. Contract N00014-75-C-0258. 451p. NTIS PC A20/MF A01.

This report has been prepared by the Committee on Biosphere Effects on Extremely-Low-Frequency Radiation in response to a request from the United States Navy for a study of the possibility that plants, people, and other animals would be harmed by the electric and magnetic fields associated with operation of the transmitter of the Seafarer communication system proposed by the Navy. (Author)

# HEALTH AND SAFETY

**22281** (RFP—2434) **Radiation monitor training program at Rocky Flats.** Medina, L.C.; Kittinger, W.D.; Vogel, R.M. (Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant). [nd]. Contract EY-76-C-04-3533. 9p. Dep. NTIS, PC A02/MF A01.

The Rocky Flats Radiation Monitor Training Program is tailored to train new health physics personnel in the field of radiation monitoring. The purpose of the prescribed materials and media is to be consistent in training in all areas of Rocky Flats radiation monitoring job involvement.

# GEOSCIENCES

## GEOLOGY AND HYDROLOGY

*REFER ALSO TO CITATION(S) 20979, 21189*

**22282** (N—77-26598) **Geophysical well logging for geohydrological purposes in unconsolidated formations.** Walter, F. (Dienst Grondwaterverkenning TNO, Delft (Netherlands)). 1976. 112p. NTIS PC A06/MF A01.

Geophysical well logging implies the recording of one or more physical variables which provide information regarding the lithology, stratography, and physico-chemical properties of the liquid filling the pores of a perforated formation. Logging methods of importance to geohydrological investigations are described. These include determination of the spontaneous potential, the formation resistivity, and the natural gamma radiation intensities of the rocks.

**22283** (Y/OWI/SUB—77/16537, pp 15p, Paper 2) **Geohydrolic studies of Gulf Coast interior salt domes.** Smith, C.G. Jr. 1977.

From Review meeting on salt dissolution; Austin, TX, USA (29 Mar 1977).

In National waste terminal storage program.

Disposal of high-level radioactive wastes in Gulf Coast salt domes requires that the cavities be free from groundwater dissolution for 250,000 years. Salinity variations of groundwater near selected domes were investigated. Saline groundwater anomalies (saline plumes) in aquifers pierced or uplifted by the dome may be the result of salt solution by groundwater. In the Northeast Texas salt dome basin electric logs of oil and gas wells have been used to estimate groundwater salinities in aquifers near selected domes. Thus far, the analyses have revealed saline groundwater anomalies around 4 of the 9 domes studied. Estimates of the rate of salt dissolution from domes associated with saline groundwater plumes indicate that less than 30 meters of salt will be removed from the upper surfaces of the dome in 250,000 years. Thus, these preliminary studies show that even apparently unstable domes may be sufficiently stable to serve as waste disposal sites. 6 figures. (DLC)

**22284** **Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau.** Symonds, P.A.; Cameron, P.J. (Bur of Miner Resour, Canberra, Aust). *APEA J.;* 17: 30-41(1977).

The Carnarvon Terrace, Wallaby Plateau and adjacent slopes cover about 350,000 km$sup 2$ beyond the continental shelf of central Western Australia. Water depths within the region range from about 600 m on the Carnarvon Terrace to 5000 m over the Cuvier Abyssal Plain. The dominant structural grain of the Carnarvon Terrace varies from north-northeast in the north to north-northwest in the south. The existence of a large trough of Mesozoic sediments that is probably a northwestern extension of the Abrolhos Sub-basin considerably upgrades the hydrocarbon potential of the southern carnarvon Terrace. Traps along the possible offshore extension of the Rough Range Fault and Devonian reef complexes within the Palaeozoic high may also be prospective for hydrocarbons. 33 refs.

## GEOPHYSICS

*REFER ALSO TO CITATION(S) 20978*

### SEISMOLOGY AND TECTONICS

*REFER ALSO TO CITATION(S) 21399, 21669*

### GEOPHYSICAL SURVEY METHODS

*REFER ALSO TO CITATION(S) 22284*

## MINERALOGY, PETROLOGY, AND ROCK MECHANICS

*REFER ALSO TO CITATION(S) 20964, 21455*

**22285** **Effect of pressure variation in a stratum on hydrodynamic characteristics of neighboring strata.** Entov, V.M.; Malakhova, T.A.; Marmorshtein, L.M. (Moscow Inst of Petrochem and Gas Ind im. I.M. Gubkin, USSR). *Izv. Vyssh. Uchebn. Zaved., Neft Gaz;* No. 4, 63-65(1977). (In Russian).

Changes in the hydrodynamic conductivity of a stratum following pressure variation in a neighboring stratum are considered. A change in pressure calls forth a change in the stress-strain state of the surrounding rocks which, in its turn, modifies their permeability.

Stress variations are calculated in accordance with the results of a preceding work by the same authors, while the dependence of permeability on average streeses is taken from published data and additionally staged experiments. The range of variation of pressure and rock properties is determined within which interaction with neighboring strata owing to changes in the state of stress has to be expected.

## GEOCHEMISTRY

*REFER ALSO TO CITATION(S) 21195*

## OCEANOGRAPHY

*REFER ALSO TO CITATION(S) 22215*

**22286** (RLO/2229/T1—40) **Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976—May 31, 1977.** Burrell, D.C. (Alaska Univ., Fairbanks (USA). Inst. of Marine Science). Jun 1977. Contract EY-76-S-06-2229-001. 26p. Dep. NTIS, PC A03/MF A01.

Results are reported from on analysis of the seasonal exchange of water between the inner basin of one typical S. Central Alaskan fjord (Resurrection Bay) and the Gulf of Alaska. This work entailed sampling on an approximately bimonthly interval for nearly four years. From this work it appeared that, at certain times of the year, the deep water of Resurrection Bay approximated a closed chemical system permitting study of the behavior of both conservative and (with ancillary information) non-conservative components. A study of the fluxes, sources and sinks for copper in this particular environment was therefore undertaken, and a brief summary of results is presented. Methods used for the chemical analysis of both inorganic and organic soluble species of Cu in seawater reported. Data on the content of soluble Cd, Cu, and Pb in samples of seawater are included.

**22287** **Currents, internal and inertial waves in a stratified ocean due to variable winds. Pt. 2.** Krauss, W. (Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde). *Dtsch. Hydrogr. Z.;* **29**: No. 4, 119-135(1976).

The response of a continuously stratified viscous ocean to a variable wind and air pressure field has been studied during recent years by means of analytical methods. This requires the assumption of constant eddy viscosity and exponential stratification. In shallow water constant eddy viscosity leads to irrealistically thick boundary layers compared to the water depth and, therefore, eliminates internal waves. In the first part of a two-part study a theoretical model has been developed for arbitrary density stratification and eddy viscosity. The results of the integration are dealt with in this second part 2.

**22288** **Currents along the Northwest African coast South of 22° North.** Mittelstaedt, E. (Deutsches Hydrographisches Inst. (DHI), Hamburg (Germany, F.R.)). *Dtsch. Hydrogr. Z.;* **29**: No. 3, 97-117(1976).

From January to March, 1972, the coastal upwelling experiment 'Auftrieb 72' took place off Northwest Africa between Cap Blanc and Cap Timiris (18° N to 21° N). A current meter array was moored across the continental slope during 3 weeks. Hydrographical data were sampled at the position of the moorings. This paper describes briefly the general hydrography and presents the situation of the mean currents in the working area.

**22289** **Growth-stage scaling model for the wind-driven sea.** Sanders, J.W. (Koninklijk Nederlands Meteorologisch Instituut, De Bilt). *Dtsch. Hydrogr. Z.;* **29**: No. 4, 136-161(1976).

The model describes the development of the wind sea on deep water. A quantity is defined that gives the growth-stage of the wind sea. The model accounts for 'overshoot' and also for the main characteristics of meteorological conditions. The stability of the air is a factor of importance besides fetch, duration and mean wind speed. Special attention is given to the measurements of the JONSWAP-experiments, as these turn out to be a special case of the meteorological conditions. It was found that the description of the wind field was by far the most important factor determining the accuracy of the ultimate results.

# PHYSICS RESEARCH

## ASTROPHYSICS AND COSMOLOGY

**22290** **Reference nuclear data for space technology.** Burrows, T.W.; Holden, N.E.; Pearlstein, S. (Brookhaven National Lab., Upton, NY). *Trans. Am. Nucl. Soc.;* **27**: 198(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### COSMIC RADIATION

*REFER ALSO TO CITATION(S) 22125*

**22291** **Radiation background in space and its evaluation.** Stassinopoulos, E.G. (NASA, Greenbelt, MD). *Trans. Am. Nucl. Soc.;* **27**: 193(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22292** **Induced radiations in spacecraft as background to gamma/x-ray measurements.** Stauber, M.C.; Suh, P.K. (Grumman Aerospace Corp., Bethpage, NY). *Trans. Am. Nucl. Soc.;* **27**: 194-195(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22293** **Calculation of radioactivity induced in scintillator materials during spaceflight.** Dyer, C.S. (Imperial College, London); Trombka, J.I.; Seltzer, S.M. *Trans. Am. Nucl. Soc.;* **27**: 195-196(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22294** **Experimental determination of cosmic-ray particle fluxes.** Reedy, R.C. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 198-199(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### STARS

**22295** (N—77-27049) **Spatial heterodyne interferometry of VY Canis Majoris, alpha Orionis, alpha Scorpii, and R Leonis at 11 microns.** Sutton, E.C.; Storey, J.W.V.; Betz, A.L.; Townes, C.H.; Spears, D.L. (California Univ., Berkeley (USA). Dept. of Physics). 1977. Contracts NGL-05-003-272;NGR-05-003-452. 18p. NTIS PC A02/MF A01.

Using the technique of heterodyne interferometry, measurements were made of the spatial distribution of 11 micron radiation from four late type stars. The circumstellar shells surrounding VY Canis Majoris, alpha Orionis, and alpha Scorpii were resolved, whereas that of R Leonis was only partially resolved at a fringe spacing of 0.4 sec.

### QUASI-STELLAR, RADIO, AND X-RAY SOURCES

**22296** (N—77-27050) **OSO-8 x-ray observations of AM Herculis.** Swank, J.; Lampton, M.; Boldt, E.; Holt, S.; Serlemitsos, P. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). May 1977. 16p. (NASA-TM-X—71313; X—661-77-104).

Hard X-ray observations of the binary system AM Her were coincident with soft X-ray and ground-based optical measurements. In the 2—60 keV band, variability was detected with an eclipse during phases 0.5 to 0.7 with respect to the 0. d 12892 period optical minima, synchronous with the known soft X-ray eclipse. The 2—60 keV uneclipsed flux was 9.5 x 10 ⁻ 10 erg sq cm/sec, of which 86% lies above 10 keV. Thus AM Her contains a hard source located near the similarly eclipsed soft X-ray source. The X-ray data are interpreted in terms of thermal bremsstrahlung from accretion onto a white dwarf.

**22297** (N—77-27061) **X-ray and gamma-ray line production by nonthermal ions.** Bussard, R.W.; Omidvar, K.; Ramaty, R. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). God-

dard Space Flight Center). Jun 1977. 35p. (NASA-TM-X—71335; X—660-77-144). NTIS PC A03/MF A01.

X-ray production was calculated at approximately 6.8 keV by the 2p to 1s transition in fast hydrogen- and helium-like iron ions, following both electron capture to excited levels and collisional excitation. A refinement of the OBK approximation was used to obtain an improved charge exchange cross section. This, and the corresponding ionization cross section, were used to determine equilibrium charge fractions for iron ions as functions of their energy. The effective X-ray line production cross section was found to be sharply peaked in energy at about 8 to 12 MeV/amu. Because fast ions of similar energies can also excite nuclear levels, the ratio of selected strong gamma ray line emissivities to the X-ray line emissivity was also calculated. Limits set by this method on the intensity of gamma ray line emission from the galactic center and the radio galaxy Centaurus A are generally lower than those reported in the literature.

**22298 Radiation in space and its effects on high-energy astronomy experiments: a summary.** Fishman, G.J. (NASA, Huntsville, AL). *Trans. Am. Nucl. Soc.;* **27**: 196-197(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

### SOLAR PHENOMENA

**22299 (N—77-27056) On three-dimensional reconstruction of optically thin solar emission sources.** Kastner, S.O.; Thomas, R.J.; Wade, C. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). May 1977. 23p. (NASA-TM-X—71341; X—682-77-136). NTIS PC A02/MF A01.

Calculations are given for constructing the three dimensional distribution of optically thin EUV emission sources associated with solar active regions, from two dimensional observations (projections) recorded by the spectroheliograph on the OSO 7 satellite. The relation of the method to other image reconstruction methods is briefly discussed as well as the special requirements imposed in the solar case such as a knowledge of the true solar rotation function. A useful correlation criterion for establishing the physical validity of solutions is given.

### GALAXIES

**22300 Analysis of "noise" in the rich absorption-line spectra of quasars. I. Method of scrambled standard lines.** Joss, P.C.; Ruffa, G.J. (Department of Physics and Center for Theoretical Physics, Massachusetts Institute of Technology). *Astrophys. J.;* **218**: No. 2, 347-352(1 Dec 1977).

We present a new method for estimating the number of accidental redshift systems in quasar absorption-line spectra. The method is based on the use of simulated sets of standard spectral lines, in which correlations among the actual line wavelengths of specific ions are neglected. We have applied our method to the observed spectra of Ton 1530, PHL 938, and PHL 957 and obtain higher estimates of the number of accidental systems than those obtained by some previous investigators. The original method devised by Bahcall (1968) gives a reasonable lower limit to the number of accidental systems, while our method gives a reasonable upper limit to the number of such systems.

**22301 Interstellar bubbles. II. Structure and evolution.** Weaver, R.; McCray, R.; Castor, J.; Shapiro, P.; Moore, R. (Department of Physics and Astrophysics, University of Colorado). *Astrophys. J.;* **218**: No. 2, 377-395(1 Dec 1977).

We present the detailed structure of the interaction of a strong stellar wind with the interstellar medium. First we give an adiabatic similarity solution, which is applicable at early times. Second, we derive a similarity solution, including the effects of thermal conduction between the hot ($T \simeq 10^6$ K) interior and the cold shell of swept-up interstellar matter. We then modify this solution to include the effects of radiative energy losses. We calculate the evolution of an interstellar bubble, including the radiative losses. The quantitative results for the outer shell radius and velocity and the column density of highly ionized species such as O VI are within a factor 2 of the approximate results of Castor, McCray, and Weaver. The effect of stellar motion on the structure of a bubble, the hydrodynamic stability of the outer shell, and the observable properties of the hot region and the outer shell are discussed.

### PLANETARY PHENOMENA

**22302 Exploration of Venus.** Colin, L. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). *Space Sci. Rev.;* **20**: No. 3, 249-258(May 1977).

This paper is an introduction to a special issue of Space Science Reviews dedicated to the exploration of Venus and the role played by the Pioneer Venus program. The Pioneer Venus program consists of a Multiprobe and Orbiter mission, both to be launched and to encounter Venus in 1978. The evolution of the program is traced from its conception in 1968 as the Goddard Space Flight Center Planetary Explorer Program through its transfer to Ames Research Center in 1971 as Pioneer Venus to the present.

**22303 Dynamics, winds, circulation and turbulence in the atmosphere of Venus.** Schubert, G. (California Univ., Los Angeles (USA)); Counselman, C.C. III; Pettengill, G.; Shapiro, I.I. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Earth and Planetary Sciences); Hansen, J.; Travis, L. (National Aeronautics and Space Administration, New York (USA). Goddard Inst. for Space Studies); Limaye, S.S.; Suomi, V.E. (Wisconsin Univ., Madison (USA). Space Science and Engineering Center); Seiff, A.; Young, R.E. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). *Space Sci. Rev.;* **20**: No. 4, 357-387(Jun 1977).

With the possible exception of the lowest one or two scale heights, the dominant mode of circulation of Venus' atmosphere is a rapid, zonal, retrograde motion. Global albedo variations in the ultraviolet may reflect planetary scale waves propagating relative to the zonal winds. Other special phenomena such as cellular convection in the subsolar region and internal gravity waves generated in the interaction of the zonal circulation with the subsolar disturbance may also be revealed in ultraviolet imagery of the atmosphere. The contributions of experiments on the Orbiter and Entry Probes of Pioneer Venus toward unravelling the mystery of the planet's global circulation and the role played by waves, instabilities and convection therein are discussed.

**22304 Pioneer Venus program.** Colin, L.; Hall, C.F. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). *Space Sci. Rev.;* **20**: No. 3, 283-306(May 1977).

The Pioneer Venus program encompasses two spacecraft missions, Orbiter and Multiprobe, to be launched and to encounter Venus during the 1978 Venus mission opportunity. The missions are described in detail including mission and spacecraft descriptions, scientific objectives and payloads. The ways in which the payloads address the major scientific questions concerning Venus are treated in subsequent papers.

**22305 Clouds of Venus.** Knollenberg, R.G. (Particle Measuring Systems, Inc., 1855 South 57th Court, Boulder, Colorado 80301, U.S.A.); Hansen, J. (National Aeronautics and Space Administration, New York (USA). Goddard Inst. for Space Studies); Ragent, B. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center); Martonchik, J. (Jet Propulsion Lab., Pasadena, Calif. (USA)); Tomasko, M. (Arizona Univ., Tucson (USA)). *Space Sci. Rev.;* **20**: No. 3, 329-354(May 1977).

The current state of knowledge of the Venusian clouds is reviewed. The visible clouds of Venus are shown to be quite similar to low level terrestrial hazes of strong anthropogenic influence. Possible nucleation and particle growth mechanisms are presented. The Pioneer Venus experiments that emphasize cloud measurements are described and their expected findings are discussed in detail. The results of these experiments should define the cloud particle composition, microphysics, thermal and radiative heat budget, rough dynamical features and horizontal and vertical variations in these and other parameters. This information should be sufficient to initialize cloud models which can be used to explain the cloud formation, decay, and particle life cycle.

**22306 Application of nuclear techniques for measurements near Jupiter.** Parker, R.H.; Luthey, J.L.; Metzger, A.E. (Jet Propulsion Lab., Pasadena, CA). *Trans. Am. Nucl. Soc.;* **27**: 193-194(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## ATMOSPHERIC PHYSICS

### AURORAL AND IONOSPHERIC PHENOMENA

**22307 (AD-A—042548) Study of the equatorial ionosphere. Interim scientific report No. 3, 1 January 1974—30 September 1976.** Koster, J.R. (Ghana Univ., Legon. Dept. of Physics). 30 Nov 1976. 26p. NTIS PC A03/MF A01.

Data from five years' daily records of the amplitude and Faraday rotation angle of the 136.47 MHz beacon on ATS-3 are analyzed to give the dependence of scintillation on sunspot number. The seasonal variation is then found. Finally, correlation among scintillation index (SI), total electron content (TEC) and magnetic activity (KP) is investigated. The diurnal, seasonal and sunspot cycle dependence of the inter-correlations is investigated.

# ATOMIC, MOLECULAR, AND CHEMICAL PHYSICS

**22308 Electronic states of $Ar^+_2$, $Kr^+_2$, $Xe^+_2$. I. Potential curves with and without spin—orbit coupling.** Wadt, W.R. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *J. Chem. Phys.;* 68: No. 2, 402-414(15 Jan 1978).

The low-lying states of $Ar^+_2$, $Kr^+_2$, and $Xe^+_2$ have been investigated using the POL CI method. Spin—orbit coupling has been included with a simple atoms-in-molecule approach. The calculated dissociation energies for the ground I (1/2)/sub u/ states of $Ar^+_2$ and $Kr^+_2$ are in good agreement (10% error) with experiment, while the agreement is slightly worse (20% error) for $Xe^+_2$. The well depth decreases from 1.19 eV in $Ar^+_2$ to 0.79 eV in $Xe^+_2$ mainly because of spin—orbit effects. As expected, the calculated bond distances increase from $Ar^+_2$ to $Xe^+_2$ as the atoms increase in size. The first excited state, I (3/2)/sub g/, possesses a small well (0.12 eV) at larger distances (3—4 A) in all the rare gas dimer ions. The higher excited states arising from the lowest asymptote are more repulsive. There are three dipole-allowed transitions from the ground state. The I (1/2)/sub u/→I (3/2)/sub g/ transition, which occurs in the near infrared, is very weak in accordance with propensity rules based on changes in Ω. The I (1/2)/sub u/→I (1/2)/sub g/ transition occurs between 700—800 nm and grows dramatically in intensity from $Ar^+_2$ to $Xe^+_2$ because of spin—orbit effects. The predicted increase in intensity is in excellent agreement with experiment. Finally, the I (1/2)/sub u/→II (1/2)/sub g/ transition is very strong with the intensity decreasing slightly for the heavier rare gas dimer ions. Although the calculated wavelengths for the peak absorption are too long by 20—30 nm, the size and shape of the calculated absorption bands should be in good agreement with experiment. Finally, a comparison is made between the ab initio SCF potentials for the $^1\Sigma^+$/sub g/ state of $Ar_2$, $Kr_2$, and $Xe_2$ with the potentials predicted by the electron gas model.

**22309 Gas phase $^{13}C$ chemical shifts and coupling constants in the deuteromethanes.** Alei, M. Jr.; Wageman, W.E. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *J. Chem. Phys.;* 68: No. 2, 783-784(15 Jan 1978).

$^{13}C$ NMR shifts and coupling constants are reported for $^{13}CH_4$, $^{13}Cl_4$, and a mixture oof $^{13}CH_4$ and $1^3CH_3D$, $^{13}CH_2D_2$, $^{13}CHD_3$ and $^{13}CD_4$. The samples were prepared by reaction f $^{13}CO$ with either pure $H_2$ or a 1:1 $H_2$:$DD_2$.(AIP)

**22310 Chemistry of the transactinide elements.** Keller, O.L. Jr.; Seaborg, G.T. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Annu. Rev. Nucl. Sci.;* 27: 139-166(Dec 1977).

The chemical, atomic, and nuclear properties of trans 104 elements are reviewed. The search for these nuclei and theoretical calculations of their characteristics are discussed.(AIP)

## BEAMS AND THEIR REACTIONS

**22311 (CONF-770931—4) Effects seen in the interactions of fast molecular-ion beams with matter.** Gemmell, D.S.; Cooney, P.J.; Pietsch, W.J.; Ratkowski, A.J.; Vager, Z.; Zabransky, B.J.; Faibis, A.; Goldring, G.; Levine, I. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 66p. Dep. NTIS, PC A04/MF A01.

From 7. international conference on atomic collisions in solids; Moscow, F.R. Germany (19 Sep 1977).

Experimental results are presented from high resolution studies of the energy- and angle-distributions for the break-up products that arise from the dissociation of a variety of fast molecular ions in thin carbon foils and in gases. The results for foil targets are compared with calculations based on a model for the polarization "wakes" induced in foils by the passage of fast charged projectiles. An example is given of the application of this type of dissociation measurement to the determination of a molecular structure--that of $H_3^+$. Also measurements on the transmission of fast molecular ions through carbon foils are described and results presented on the transmission probabilities, energy losses and angular distributions of the transmitted ions.

**22312 (LBL—6017) Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction.** Firment, L.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1977. Contract W-7405-ENG-48. 432p. Dep. NTIS, PC A19/MF A01.

Thesis.

The structures of molecular crystal surfaces were investigated for the first time by the use of low-energy electron diffraction (LEED). The experimental results from a variety of molecular crystals were examined and compared as a first step towards understanding the properties of these surfaces on a microscopic level. The method of sample preparation employed, vapor deposition onto metal single-crystal substrates at low temperatures in ultrahigh vacuum, allowed concurrent study of the structures of adsorbed monolayers on metal surfaces and of the growth processes of molecular films on metal substrates. The systems investigated were ice, ammonia, naphthalene, benzene, the n-paraffins ($C_3$ to $C_8$), cyclohexane, trioxane, acetic acid, propionic acid, methanol, and methylamine adsorbed and condensed on both Pt(111) and Ag(111) surfaces. Electron-beam-induced damage of the molecular surfaces was observed after electron exposures of $10^{-4}$ A sec $cm^{-2}$ at 20 eV. Aromatic molecular crystal samples were more resistant to damage than samples of saturated molecules. The quality and orientation of the grown molecular crystal films were influenced by substrate preparation and growth conditions. Forty ordered monolayer structures were observed. 110 figures, 22 tables, 162 references.

**22313 Analysis of bunching of an electron beam at optical wavelengths.** Chen, C.K.; Sheppard, J.C.; Piestrup, M.A.; Pantell, R.H. (Department of Electrical Engineering, Stanford University, Stanford, California 94305). *J. Appl. Phys.;* 49: No. 1, 41-46(Jan 1978).

This paper presents an analysis of the bunching of an electron beam at optical wavelengths by means of the inverse Cerenkov effect. A laser light beam is used to modulate the velocity of the electrons, and this velocity modulation becomes charge-density modulation after an appropriate drift distance. The effects of energy and angular spread of the electrons are included, as well as the impact of scatterings in the index-matching medium. Bunching can occur with reasonable parameter values and the drift distance is on the order of several centimeters.

## ATOMIC AND MOLECULAR PROPERTIES

*REFER ALSO TO CITATION(S) 21883, 22311, 22320*

**22314 (CONF-770935—4) Angular distributions of photoelectrons and non-thermal photoions from atoms and molecules.** Dehmer, J.L. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 25p. Dep. NTIS, PC A02/MF A01.

From 5. international conference on vacuum ultraviolet radiation physics; Montpellier, France (5 Sep 1977).

During the last ten years, photoelectron angular distributions have been used extensively to study the dynamics of the photoionization process in atoms and molecules. Some major advances in this body of work are reviewed with special emphasis on results emerging since the last Conference on VUV Radiation Physics three years ago. By far the greatest progress has occurred for atoms, where interest is focussed on improving zero-order (Hartree-Slater, Cooper-Zare) understanding of the asymmetry parameter β(epsilon), by considering electron correlations, relativistic effects, and anisotropic final-state interactions. The study of the rare gases has benefitted from extensive coordination between experiment and theory, whereas work on nonspherical atoms has been mainly theoretical, with the only measurements being performed very recently on atomic oxygen. Angular distribution studies on molecules are in a much earlier stage of development. Progress has been impeded by the lack of practical, realistic theoretical methods and wavelength-dependent measurements, both of which are becoming available only now. This recent work, together with selected topics from earlier resonance-line work on molecules will be reviewed. In addition, a new class of angular-dependent studies of molecules will be discussed--the angular distribution of nonthermal ions formed by dissociative photoionization--which provides information complementary to the related measurements on photoelectrons.

**22315 Photoionization of uranium atoms by an argon ion laser.** Mochizuki, T.; Morikawa, M.; Yamanaka, C. (Institute of Laser Engineering, Osaka University, Suita, Yamada-Kami, Osaka, Japan). *Appl. Phys. Lett.;* 32: No. 4, 212-214(15 Feb 1978).

The pohotoionization of uranium atoms by the 3511- and 3345-A uv lines from an argon ion laser was observed and attributed to resonant two-photon ionization. Application to uranium laser isotope separation is discussed.

**22316 Revised central force potentials for water.** Stillinger, F.H.; Rahman, A. (Bell Laboratories, Murray Hill, New Jersey 07974). *J. Chem. Phys.;* 68: No. 2, 666-670(15 Jan 1978).

Computer simulation by the molecular dynamics technique has been used to investigate a modification of the previously introduced "central force model" for liquid water. The simulation involved 216 molecules, with periodic boundary conditions and Ewald summation, at 29.5°C and 1 $g/cm^3$. In all respects considered (pressure, energy, pair correlation functions, self-diffusion rate) the revised set of interactions represents water more accurately than the earlier set.

## POSITRONIUM, MUONIUM, AND MUONIC AND MESIC ATOMS AND MOLECULES

**22317** (CONF-761027—26) **Theory of the temperature dependence of positron bulk lifetimes-implications for vacancy formation enthalpy measurements via positron experiments.** Tam, S.W.; Sinha, S.K.; Siegel, R.W. (Argonne National Lab., Ill. (USA)). Feb 1977. Contract W-31-109-ENG-38. 11p. Dep. NTIS, PC A02/MF A01.

From International conference on properties on atomic defects on metals; Argonne, IL, USA (18 Oct 1976).

Temperature dependent effects, which may have a bearing on determinations of vacancy formation enthalpies in metals by positron annihilation, have been observed in certain metals. These effects have been observed to occur both at temperatures below those at which positron annihilation is most sensitive to equilibrium vacancies and at temperatures well within the vacancy-sensitive region. The effect of thermal lattice displacements on positron lifetimes in metals was investigated to help understand these phenomena. (GHT)

**22318** **Circular polarization of muonic x rays and origin of strange $\mu^-$ depolarization in Pd metal.** Yamazaki, T.; Hayano, R.S.; Imazato, J.; Negamine, K.; Huang, C.Y.; Boehm, F. (Department of Physics, University of Tokyo, Bunkyo-ku, Tokyo, Japan). *Phys. Rev. Lett.;* **39**: No. 23, 1462-1465(5 Dec 1977).

The circular polarization of muonic x rays has been measured in order to investigate the mechanism of the unexpectedly fast depolarization of the negative muon in Pd metal as observed by the negative-muon spin-rotation method. A large circular polarization consistent with the maximal theoretical value was observed in both Pd and Cd metals, showing that the polarization is preserved up to the time the muon reaches the 1s atomic ground state.

## COLLISION PHENOMENA

**22319** **Quasiclassical trajectory study of the energy transfer in $CO_2$—rare gas systems.** Suzukawa, H.H. Jr.; Wolfsberg, M.; Thompson, D.L. (Department of Chemistry, University of California, Irvine, California 92717). *J. Chem. Phys.;* **68**: No. 2, 455-472(15 Jan 1978).

Computational methods are presented for the study of collisions between a linear, symmetric triatomic molecule and an atom by three-dimensional quasiclassical trajectory calculations. Application is made to the investigation of translational to rotational and translational to vibrational energy transfer in the systems $CO_2$—Kr, $CO_2$—Ar, and $CO_2$—Ne. Potential-energy surfaces based on spectroscopic and molecular beam scattering data are used. In most of the calculations, the $CO_2$ molecule is initially in the quantum mechanical zero-point vibrational state and in a rotational state picked from a Boltzmann distribution at 300°K. The energy transfer processes are investigated for translational energies ranging from 0.1 to 10 eV. Translational to rotational energy transfer is found to be the major process for $CO_2$—rare gas collisions at these energies. Below 1 eV there is very little translational to vibrational energy transfer. The effects of changes in the internal energy of the molecule, in the masses of the collidants, and in the potential-energy parameters are studied in an attempt to gain understanding of the energy transfer processes.

**22320** **Doublet→quartet transitions in nitric oxide as detected by electron-impact spectroscopy.** Frueholz, R.P.; Rianda, R.; Kuppermann, A. (Arthur Amos Noyes Laboratory of Chemical Physics,/ sup c/ California Institute of Technology, Pasadena, California 91125). *J. Chem. Phys.;* **68**: No. 2, 775-776(15 Jan 1978).

Vibronic bands in NO are investigated using electron beam excitation. The beams had energies of 25, 35, and 50 eV. (AIP)

**22321** **Some features of the potential energy surfaces for the $F^+ + H_2$ ion—molecule reaction.** Mahan, B.H.; Schaefer III, H.F.; Ungemach, S.R. (Department of Chemistry and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *J. Chem. Phys.;* **68**: No. 2, 781-782(15 Jan 1978).

Potential energy surfaces for the $F^+ + H_2$ ion-molecule reaction are studied theoretically.(AIP)

**22322** **Deactivation of vibrationally excited ozone by $O(^3P)$ atoms.** West, G.A. (Brookhaven National Lab., Upton, NY); Weston, R.E. Jr.; Flynn, G.W. *Chem. Phys. Lett.;* **42**: No. 3, 488-493(15 Sep 1976).

Using laser-induced fluorescence of ozone (to measure the rate of disappearance of $O_3$) and $NO_2$ titration (to determine O atom concentrations), we have determined bimolecular rate constants for the deactivation by O ($^3P$ atoms) of ozone in excited stretching and bending modes. These experiments do not distinguish between deactivation by (a) the exchange of vibrational and translational energy or (b) the chemical reaction $O_3 + O \rightarrow 2O_2$. If the non-reactive pathway (a) is assumed to dominate, then $O(^3P)$ is 150 times more effective than $O_2$ in deactivating $O_3$. If chemical reaction (b) is dominant, the biomulecular rate constant for $O_3 + O(^3P)$ is larger by a factor of 150 to 1500 than that for ground-state ozone.

## ATOMIC AND MOLECULAR THEORY

*REFER ALSO TO CITATION(S) 22130*

# GENERAL FLUID DYNAMICS

**22323** (UCID—17680) **LEG System: a general Lagrangian-to-Eulerian hydrodynamic code linkage.** Warshaw, S.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1977. Contract W-7405-ENG-48. 34p. Dep. NTIS, PC A03/MF A01.

The LEG system is a user-oriented three-code system which can map any two-dimensional Lagrangian calculation data on to any rectangular two-dimensional Eulerian mesh for subsequent multi-fluid Eulerian calculations. A working version was developed on the CDC 7600, which links Lagrangian codes to BBC, and also accepts Eulerian output from other link systems. Details of the mapping transformations and execution of the codes are given. 3 figures.

# MAGNETOHYDRODYNAMICS

*REFER ALSO TO CITATION(S) 21764*

# OTHER QUANTUM FLUIDS

**22324** (TID—27646) **Measurements of the osmotic pressure in liquid mixtures of $^3He$ and $^4He$ near the lambda line and tricritical point.** Gearhart, C.A. Jr. (Minnesota Univ., Minneapolis (USA)). Jun 1977. Contract EY-76-S-02-1569. 215p. (E—1569-143). Dep. NTIS, PC A10/MF A01.

Thesis.

Values of the concentration susceptibility near the lambda line and tricritical point in liquid mixtures of $^3He$ and $^4He$ have been calculated from measurements of osmotic pressure differences. Measurements were made by inducing a small $^3He$ mole fraction difference $\Delta x$ between two chambers separated by a pressure transducer, and measuring the resulting osmotic pressure difference as a function of temperature. Osmotic equilibrium was established through a Vycor glass superleak, which for $^3He$ mole fraction $x > 0.55$ functions not only in the superfluid phase but in portions of the normal fluid region of the phase diagram as well. Measurements were made at four $^3He$ mole fractions, $x = 0.59$, $x = 0.64$, $x = 0.68$, and $x = 0.70$. In contrast with determinations from light scattering and vapor pressure measurements, the present measurements show a pronounced peak at the lambda transition for the two values of x less than the tricritical value (x/sub t/ = 0.675). The susceptibilities are consistent with $\alpha = 0$ both above and below the lambda transition except at $x = 0.64$, where some combination of $\alpha$ and $\alpha'$ greater than zero seems to be preferred. (The result $\alpha = 0$ corresponds to a logarithmic divergence.) It is possible that this positive value of $\alpha$ or $\alpha'$ represents the influence of tricritical effects. It should be emphasized that there is considerable ambiguity in our determination of $\alpha$, with acceptable least-squares fits corresponding to values of $\alpha$ between 0.0 and 0.2 being found at both concentrations, both above and below T/sub $\lambda$/. The results appear to be consistent with the results of other experiments away from the lambda line, and also to be consistent with a simple tricritical scaling relationship.

**22325** **Positive ion mobility in normal $^3He$.** Roach, P.D.; Ketterson, J.B. (Northwestern Univ., Evanston, Ill. (USA). Dept. of Physics); Roach, P.R. (Argonne National Lab., Ill. (USA)). *Phys. Lett., A;* **63**: No. 3, 273-274(14 Nov 1977).

The mobility of positive ions in pure $^3He$ and in a solution with 300 ppm $^4He$ are reported for a pressure of 60 torr.

# HIGH ENERGY PHYSICS

**22326** (COO—1545-222) **High energy physics studies progress report. Part I. Experimental program.** (Ohio State Univ. Research Foundation, Columbus (USA)). 1977. Contract EY-76-C-02-1545. 44p. Dep. NTIS, PC A03/MF A01.

The experimental program of research, including Assembly of an experiment at Fermilab E-351 to measure decay lifetimes, with tagged emulsion, of charmed particles produced by high energy neutrinos will continue. A data-taking run will take place in the coming fiscal year. Participation in the neutrino experiment E-310, Fermilab-Harvard-Pennsylvania-Rutgers-Wisconsin, will also continue. Data analysis from several experiments performed in the recent past at the ZGS ANL is in progress and will be pursued. These experiments are, E-397, E-420 and E-428 performed with the Charged and Neutral Spectrometer, and E-347 with the $\Sigma$/sub $\beta$/ Spectrometer. Plans are in the making to collaborate with a polarized proton experiment at the ZGS. New approaches to "third

generation" neutrino experiments at Fermilab are being discussed by the whole high energy group. Ideas of pursuing experiments at the AGS-BNL with the Σ/sub β/ Spectrometer are explored. The theoretical research program covers topics of current interest in particle theory which will be investigated in the coming year; namely, the role of instantons in quantum chromodynamics, Higgs Lagrangian involving scalar fields, phenomenology of neutrino physics and in particular the nature of trimuon production, higher order symmetries like SU(3) x U(1) SU(5) and SU(6), dynamics of high energy diffractive scattering, classical solutions to the gauge field theories.

## PARTICLE INTERACTIONS AND PROPERTIES - EXPERIMENTAL

### ELECTROMAGNETIC INTERACTIONS

*REFER ALSO TO CITATION(S) 22119, 22339, 22340*

**22327 Search for neutral heavy leptons.** Meyer, D.I.; Nguyen, H.K.; Abrams, G.S.; Alam, M.S.; Barbaro-Galtieri, A.; Boyarski, A.M.; Dorfan, J.M.; Ely, R.; Feldman, G.J.; Feller, J. (Stanford Linear Accelerator Center, Calif. (USA)). *Phys. Lett., B;* **70**: No. 4, 469-470(24 Oct 1977).

In $e^+e^-$ annihilations at SPEAR the authors have searched for narrow neutral resonances in the eπ and μπ channels for masses between 0.5 GeV/c² and 1.5 GeV/c². No evidence for such states has been found. Under standard theoretical assumptions for production cross sections and decay branching ratios of heavy leptons a lower limit of 1.2 GeV/c² can be set on the mass.

**22328 Properties of the proposed tau charged lepton.** Perl, M.L.; Feldman, G.J.; Abrams, G.S.; Alam, M.S.; Boyarski, A.M.; Breidenbach, M.; Dorfan, J.; Chinowsky, W.; Goldhaber, G.; Hanson, G. (Stanford Linear Accelerator Center, Calif. (USA)). *Phys. Lett., B;* **70**: No. 4, 487-490(24 Oct 1977).

The anomalous eμ and 2-prong μx events produced in $e^+e^-$ annihilation are used to determine the properties of the proposed tau charged lepton. It is found that the tau mass is 1.90 +- 0.10 GeV/c², the mass of the associated neutrino, γsub(tau), is less than 0.6 GeV/c² with 95% confidence; V - A coupling is favored over V + A coupling for the tau-γsub(tau) current; and the leptonic branching ratios are 0.186 +- 0.010 +- 0.028 from the eμ events and 0.175 +- 0.027 +- 0.030 from the μx events where the first error is statistical and the second is systematic.

**22329 Why the neutron isn't all neutral.** Carlitz, R.D.; Ellis, S.D. (Washington Univ., Seattle (USA). Dept. of Physics); Savit, R. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). *Phys. Lett., B;* **68**: No. 5, 443-446(4 Jul 1977).

Experimental measurements of the electric form factor of the neutron indicate a spatially inhomogeneous distribution of charge. The quark model, with a spatially dependent spin-spin interaction, can accurately describe this inhomogeneity. The neutron's charge radius is related to the nucleon-delta mass difference and other experimental consequences of the inhomogeneity are discussed.

### WEAK INTERACTIONS

**22330 Neutrino and antineutrino proton scattering data and the ratio of down to up quarks in the proton.** Farrar, G.R. (California Inst. of Tech., Pasadena (USA)); Schreiner, P. (Argonne National Lab., Ill. (USA)); Scott, W.G. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). *Phys. Lett., B;* **69**: No. 1, 112-114(18 Jul 1977).

New data on the x-dependence of the ratio of down to up quarks in the proton are presented from neutrino and antineutrino experiments using the Fermilab 15-foot bubble chamber filled with hydrogen. The new data are in good agreement with existing data from electron scattering experiments performed at SLAC but are not accurate enough at large x to discriminate between the QCD prediction and a (1-x) behavior as x→1.

**22331 Polarization of prompt muons produced at large transverse momenta.** Grannan, D.M.; Adair, R.K.; Kasha, H.; Kellogg, R.G.; Lauterbach, M.J. (Yale Univ., New Haven, Conn. (USA)); Lai, K.W.; Larsen, R.C.; Lee, Y.Y.; Leipuner, L.B.; Morse, W.M. (Brookhaven National Lab., Upton, N.Y. (USA)). *Phys. Lett., B;* **69**: No. 1, 125-128(18 Jul 1977).

The longitudinal and transverse polarization of prompt muons produced at approximately 2 GeV/c transverse momentum by the interaction of 28.5 GeV protons on tungsten has been measured. Both components of the polarization were found to be consistent with zero: Psub(L)=-0.15+-0.18 and Psub(T)=0.05+-0.05.

**22332 (LA-tr—77-76) Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions.** Daum, M.; Frosch, R.; Steiner, E. (Schweizerisches Inst. fuer Nuklearforschung, Villigen; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Hochenergiephysik). 1977. Translation of PF-HE—71-8. 24p. Dep. NTIS, PC A02/MF A01.

The proposed experiment of a precision measurement of $\mu^+$ impulses at the time of decay into $\mu + \nu$ by discrimination of arrested pions is described as regards the facilities and methods to be used. The relative impulse error is expected to be improved by one order of magnitude. The experiment will result in an important contribution to the determination of the $\pi^+$ and ν/sub μ/ masses. 12 references. (JFP)

### STRONG BARYON-INDUCED INTERACTIONS

*REFER ALSO TO CITATION(S) 22330*

**22333 Diffraction dissociation of high-energy protons on hydrogen and deuterium targets.** Akimov, Y.; Bartenev, V.; Cool, R.; Goulianos, K.; Gross, D.A.; Jenkins, E.; Malamud, E.; Markov, P.; Mukhin, S.; Nitz, D.; Olsen, S.L.; Sandacz, A.; Segler, S.L.; Sticker, H.; Yamada, R. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Phys. Rev. Lett.;* **39**: No. 23, 1432-1435(5 Dec 1977).

We report results from a measurement of the inclusive processes pp → Xp and pd → Xd in the range 5 < M/sub x//sup ts2//s < 0.1, 0.01 9 or ≈ 0.1 (GeV/c)², and incident proton momenta of 65, 154, and 372 GeV/c. Both pp and pd data show an exponential t dependence and a dominant 1/M/sub x//sup ts2/ behavior for M/sub x//sup ts2//s 9 or ≈ 0.05. By comparing pp and pd data we test factorization and, using the Glauber model, we measure the XN total cross section, σ/sub X N/ = 43 +- 10 mb.

**22334 Measurement of the dihadron mass continuum in p-Be collisions and a search for narrow resonances.** Kephart, R.D.; Engelmann, R.J.; Fisk, R.J.; Good, M.L.; Ito, A.S.; Joestlein, H.; Kaplan, D.M.; McCarthy, R.L.; Wahl, H.; Herb, S.W.; Hom, D.C.; Lederman, L.M.; Sens, J.C.; Snyder, H.D.; Yoh, J.K.; Appel, J.A.; Brown, B.C.; Brown, C.N.; Innes, W.R.; Ueno, K. (State University of New York at Stony Brook, Stony Brook, New York 11794). *Phys. Rev. Lett.;* **39**: No. 23, 1440-1443(5 Dec 1977).

We have studied the high-mass dihadron continuum in 400-GeV p-Be collisions over the mass range 4—10 GeV. The experiment was performed at Fermilab using a double arm magnetic spectrometer including Cerenkov particle identification. Mass spectra for all combinations formed with an identified $\pi^{+-}$ $K^{+-}$ or p (p-bar) in each arm have been examined. No evidence for resonance production was observed. Results on mass an p/sub T/ dependence of the dihadron inclusive cross sections are presented.

**22335 Measurements of the total cross-section difference and the parameter Csub(LL) in pp scattering with longitudinally polarized beam and target.** Auer, I.P.; Beretvas, A.; Colton, E.; Hill, D.; Nield, K.; Spinka, H.; Underwood, D.; Watanabe, Y.; Yokosawa, A. (Argonne National Lab., Ill. (USA)). *Phys. Lett., B;* **70**: No. 4, 475-478(24 Oct 1977).

The authors have measured the difference between the pp total cross-sections for parallel and anti-parallel longitudinal spin states at beam momenta of 3 and 6 GeV/c. These results, combined with previous measurements, at lower momenta, are useful in clarifying a striking structure appearing at around 1.5 GeV/c. The spin-spin correlation parameter Csub(LL)(t) in pp elastic scattering at 6 GeV/c has also been measured for the first time. Evidence for an exchange with $A_1$-like quantum-numbers is observed.

**22336 Multiple generation of particles in collisions of nuclei of energy higher than $10^{12}$ eV.** Szomodyi, A.; Sugar, S.; Chadraa, B.; Basina, Y.; Brikker, S.; Grigorov, N.; Grigor'eva, L.; Kondrat'eva, M.; Mishchenko, L.; Nummik, R.; Papina, L.; Podgurskaya, L.; Poperekova, L.; Raporport, I.; Sokolov, V.; Tret'yakova, C.; Chikova, L.; Shestoperov, V.; Shopenberg, Z.; Batskan, B.; Neachu, D.; Haidue, M.; Visky, T.; Dubinski, J.; Just, L. (Budapest—Ulan-Bator—Moscow—Bucharest—Kosice Collaboration). *JETP Lett. (USSR) (Engl. Transl.);* **26**: No. 1, 46-48(5 Jul 1977).

The average multiplicity in the interaction of primary cosmic-ray particle nuclei with emulsion nuclei, referred to one interacting nucleon, measured in an emulsion stack exposed on the "Interkosmos-6"satellite, turned out to be less than the value expected for expected for indpendent nucleon-nuclear collisions.

**22337 Experimental study of Λp and $\Xi^0$p interactions in the range 1-10 GeV/c.** Hauptman, J.M.; Kadyk, J.A.; Trilling, G.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nucl. Phys., B;* **125**: No. 1, 29-51(4 Jul 1977).

The reactions Λp→Λp, $\rightarrow\Sigma^{+-}p\pi^{-+}$, $\rightarrow\Lambda p\pi^+\pi^-$ and $\rightarrow\Sigma^0$p have been studied in the SLAC 82 inch bubble chamber for incident Λ particles in the momentum range 1-10 GeV/c. The incident Λ flux was produced by the exposure of a platinum target mounted inside the chamber to a 12 GeV $K^-$ beam. A total of 992 events have been analyzed. The reactions are found to be qualitatively similar to corresponding nucleon-nucleon reactions. In particular, the slope

parameter B in the elastic cross section dsigma/dt=Aesup(Bt) has been determined as a function of incident momentum and found to be consistent with that for proton-proton elastic scattering. Angular distributions for the inelastic channels are compared with those of similar nucleon-nucleon reactions, and predictions of relevant exchange models.

**22338** (LA-tr—77-74) **Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering.** Gruebler, W.; Koenig, V.; Schmelzbach, P.A.; Stammbach, T. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik; Schweizerisches Inst. fuer Nuklearforschung, Villigen). 1977. Translation of R—73-01.1. 9p. Dep. NTIS, PC A02/MF A01.

A double scatter experiment is proposed in which the tensor polarization of the recoil deuterons is measured in the forwards direction. It is noted that using a relatively simple measurement arrangement and a short measurement time, the D-state admixture in deuterons can be determined very precisely. The experimental facilities and arrangments, structural predictions, estimate of collision rates and measurement time, background, possible improvements, and the equipment and financing are discussed. 3 references. (JFP)

### STRONG MESON-INDUCED INTERACTIONS

*REFER ALSO TO CITATION(S) 22338*

**22339** (SLAC-PUB—1602) **Properties of the psi resonances.** Breidenbach, M. (Stanford Linear Accelerator Center, Calif. (USA)). Jul 1975. Contract EY-76-S-03-0326. 24p. Dep. NTIS, PC A02/MF A01.

Sharp peaks are seen in the electron-positron annihilation cross section corresponding to the psi' at 3.095 GeV and the psi' at 3.684 GeV. Cross sections for the psi and psi' decay into hadrons, $e^+e^-$ pairs, and $\mu^+\mu^-$ pairs are used to deduce the widths and quantum numbers of the psi and psi'. Studies of the decay modes are used to determine the G-parity of the psi and the existence of a two-pion cascade decay from the psi' to the psi. No other narrow resonances were found with masses between 3.2 and 7.6 GeV.

## PARTICLE INTERACTIONS AND PROPERTIES - THEORETICAL

### GENERAL

**22340** **Composite models of hadrons and large transverse processes.** Brodsky, S.J. (Stanford Linear Accelerator Center, Calif. (USA)). pp 676-690 of In Few body problems in nuclear and particle physics. Slobodrian, R.J.; Cujec, B.; Ramavataram, K. (eds.). Quebec, Canada; Les presses de l'Universite Laval (1975). (In French, English)

From Conference on few body problems in nuclear and particle physics; Quebec, Canada (27 Aug 1974).

See CONF-740822—.

The internal structure of the hadrons is being resolved through measurements of deep inelastic scattering of electrons, muons, and neutrinos, and most recently, through large transverse momentum processes involving the collisions of hadrons. The most recent measurements have shown that the cross section for hadron production at large transverse momentum is much larger than what would be extrapolated from the fast exponential fall-off of low momentum transfer reactions. Moreover, a striking pattern of scaling laws observed in both exclusive and inclusive processes at large transverse momentums has given support to the quark-parton field-theoretic models of composite hadrons, and some basic properties of the underlying dynamics of the constituents are now beginning to emerge.

**22341** (FERMILAB-Conf—77/66-THY) **High energy spectroscopy.** Lipkin, H.J. (Argonne National Lab., Ill. (USA); Fermi National Accelerator Lab., Batavia, Ill. (USA)). Jul 1977. Contract W-7405-ENG-38;EY-76-C-02-3000. 47p. (CONF-770338—3). Dep. NTIS, PC A03/MF A01.

From Isabelle workshop; Upton, NY, USA (30 Mar 1977).

Some general guidelines are given for high energy spectroscopy pointing out crucial differences between the search for new objects at high masses and conventional low energy spectroscopy. Some puzzles and open questions in conventional spectroscopy are reviewed which might find solutions in experiments at higher energies. 66 references. (JFP)

**22342** **Suggestion for a dibaryon resonance in the pp system.** Hidaka, H.; Beretvas, A.; Nield, K.; Spinka, H.; Underwood, D.; Watanabe, Y.; Yokosawa, A. (Argonne National Lab., Ill. (USA)). *Phys. Lett., B;* **70**: No. 4, 479-481(24 Oct 1977).

The existence of a diproton resonance is indicated by the energy dependence of Legendre expansion coefficients of Pdsigma/d$\Omega$ for pp elastic scattering and the structure appearing in the data of $\Delta$sigmasub(L) = sigmasup(Tot)(anti-parallel longitudinal spin states) - sigmasup(Tot)(parallel longitudinal spin states). The properties of such a resonance are described.

### ELECTROMAGNETIC INTERACTIONS

**22343** **Weak neutral currents and photoproduction of lepton pairs.** Mikaelian, K.O.; Oakes, R.J. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). *Phys. Lett., B;* **70**: No. 3, 358-360(10 Oct 1977).

The consequence of weak neutral currents in the photoproduction of lepton pairs at high energies have been explored. Specifically the effects of the parity nonconserving interference between the weak amplitude and the purely electromagnetic Bethe-Heitler amplitude have been calculated. This interference contributes to an asymmetry between the lepton pairs and, in addition, the leptons acquire a longitudinal polarization. Numerical results are presented for the Weinberg-Salam model and are typically a few percent in magnitude.

**22344** **Single-cluster descriptions of jets in $e^+e^-$ annihilation.** Goldman, T.; Slansky, R. (Los Alamos Scientific Lab., N.Mex. (USA)). *Phys. Lett., B;* **69**: No. 1, 58-60(18 Jul 1977).

It is possible to describe the jet structure observed in $e^+e^-$ annihilations by a single spin-one cluster which couples directly to the photon, and decays by sequential pion emission. An explicit decay matrix element which reproduces the experimental results is shown.

### WEAK INTERACTIONS

**22345** **Production of charmed particles in weak interactions with diagonal neutral currents.** Choban, E.A.; Shekhter, V.M. (Leningrad Polytechnic Institute). *JETP Lett. (USSR) (Engl. Transl.);* **26**: No. 1, 42-46(5 Jul 1977).

We estimate the cross sections for the production of charmed hadrons via the neutral current in the interaction of neutrinos or antineutrinos with nucleons. The ratio of these cross sections to the total cross sections with charged currents if of the order of several per cent. Estimates are presented of the contribution of the neutral current to the production of dimuons and single "irregular" leptons.

**22346** **Relative yield of D mesons in hadronic collisions.** Kartvelishvili, V.G.; Likhoded, A.K. (Institute of High-Energy Physics). *JETP Lett. (USSR) (Engl. Transl.);* **26**: No. 1, 48-51(5 Jul 1977).

The smallness of the c-quark sea in ordinary hadrons leads to the need for considering two-gluon charm production. For the case of D mesons this corresponds to the production of small invariant masses of the DD-bar pair and dominance of the first two partial waves of the cc-bar quarks. The smallness of the interaction that leads to hyperfine D-D* splitting causes the D* to have a larger production cross section than D, i.e., $\sigma$ (D*D-bar*) $>>\sigma$ (DD-bar).

### STRONG INTERACTIONS, GENERAL

*REFER ALSO TO CITATION(S) 22380*

**22347** (SLAC-PUB—2051) **Possible connections between hard and soft processes.** Blankenbecler, R. (Stanford Linear Accelerator Center, Calif. (USA)). Oct 1977. Contract EY-76-S-03-0326. 8p. (CONF-771089—3). Dep. NTIS, PC A02/MF A01.

From Particles and fields meeting; Argonne, IL, USA (6 Oct 1977).

Three topics in constituent hadron models are reviewed: the connection between fixed angle and Regge behavior, the validity of the hard scattering expansion and restrictions on the effects of the transverse momentum of constituents, and the x distribution in the fragmentation region at low transverse momentum. 6 figures.

**22348** (SRO—946-1) **High energy hadron—hadron collisions. Annual progress report.** Chou, T.T. (Georgia Univ., Athens (USA). Dept. of Physics). Oct 1977. Contract EY-76-S-09-0946. 11p. Dep. NTIS, PC A02/MF A01.

Work on high energy hadron collisions in the geometrical picture, performed under the ERDA Contract No. E(38-1)-946, is summarized. Comparisons with new experimental results are made. Specific items discussed include the hadronic matter distribution for mesons and the comparison of theoretical prediction with a recent experiment, the possible existence of a second minimum in elastic pp scattering at very high energies, the analysis of the energy dependence of opaqueness in pp collisions, and the study of spin effects in high energy polarized Kd elastic scattering.

**22349** **Psionic matter.** Chinowsky, W. (Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Annu. Rev. Nucl. Sci.;* **27**: 393-464(Dec 1977).

The production, mass, spin, decay and intermediate states of psi (3095) and psi(3684) are reviewed. Theoretical interpretations in terms of charmed quarks are given. (AIP).

### STRONG INTERACTIONS, BARYON NO.=0

**22350** (FERMILAB-Conf—77/65-THY) **Theoretical review of strange and nonstrange mesons.** Lipkin, H.J. (Argonne National Lab., Ill. (USA); Fermi National Accelerator Lab., Batavia, Ill. (USA)). Jul 1977. Contract W-7405-ENG-38;EY-76-C-02-3000. 33p. (CONF-770406—4). Dep. NTIS, PC A03/MF A01.

From 5. international conference on experimental meson spectroscopy; Boston, MA, USA (29 Apr 1977).

The review of mesons covers strangeness and spin mass splittings, exotic hadrons, the strange axial vector mesons (Q's), new features of high mass spectroscopy, mixing of pseudoscalar mesons, meson spectroscopy and the charge of the quark, and SU(6) revisited. 43 references. (JFP)

**22351** $Q_1(1290)$ **and** $Q_2(1400)$ **decay rates and their SU(3) implications.** Carnegie, R.K.; Cashmore, R.J.; Dunwoodie, W.M.; Lasinski, T.A.; Leith, D.W.G.S. (Stanford Linear Accelerator Center, Calif. (USA)). *Phys. Lett., B;* **68**: No. 3, 287-291(6 Jun 1977).

The known information on the decay rates of the strangeness-one axial vector mesons, $Q_1$ and $Q_2$ is summarized and combined. From this information and the rate for B→ωπ, the Qsub(A)-Qsub(B) mixing angle and the S-wave symmetric and antisymmetric octet couplings for vector-pseudoscalar decays of axial vector mesons are determined. If the D(1285) and the E(1420) belong to the fsup(PC)=$1^{++}$ nonet, the $A_1$ is found to have a mass of approximately 1.47 GeV and a large (>0.3 GeV) width.

### STRONG INTERACTIONS, BARYON NO. GREATER THAN 1

*REFER ALSO TO CITATION(S) 22381*

## PARTICLE INVARIANCE PRINCIPLES AND SYMMETRIES

### APPLICATIONS TO STRONG INTERACTIONS

**22352** **Chiral symmetry breaking and the quark model: unification of baryon and meson constraints.** Gunion, J.F. (Stanford Linear Accelerator Center, Calif. (USA)); McNamee, P.C.; Scadron, M.D. (Arizona Univ., Tucson (USA)). *Nucl. Phys., B;* **123**: No. 3, 445-492(30 May 1977).

The subject of chiral symmetry breaking and its connection with the quark model is reviewed. When the light plane SU(3) charges and quark field density matrix elements are transformed back to the usual static basis it becomes clear that expectation values of chiral breaking operators do not necessarily have simple SU(3) transformation properties. Starting with the standard current quark chiral Hamiltonian H'=msub(u)anti uu+msub(d)anti dd+msub(s)anti ss, current quark light-cone distribution function concepts are then used in combination with constraints from (i) Compton amplitude fixed poles, (ii) baryon octet and decuplet mass differences, (iii) πN and KN sigma terms, (iv) Gsub(A)/Gsub(V), (v) low-energy π photoproduction multipoles, (vi) Goldberger-Treiman discrepancies, (vii) meson mass ratios in PCAC and, (viii) meson mass differences. The results are all mutually consistent. In particular the independent baryon and meson sectors of the theory are completely compatible.

# PHYSICS RESEARCH (CONT.)

## NUCLEAR PHYSICS

**22353** **Nuclear data sheets.** Anon(Oak Ridge National Laboratory P. O. Box X, Oak Ridge, Tennessee 37830). (I 0130Kj). *Nucl. Data Sheets;* **22**: No. 3, 325-431(Nov 1977).

References, key words, key numbers, and reaction indexing are given for all literature received by the Nuclear Data Project or assigned key numbers between May 1977 and August 1977.(AIP)

### ENERGY LEVELS AND TRANSITIONS

*REFER ALSO TO CITATION(S) 22380*

## NUCLEAR PROPERTIES AND REACTIONS, A=6-19, EXPERIMENTAL

### NUCLEAR REACTIONS AND SCATTERING

**22354** **Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$.** Blanpied, G.S.; Coker, W.R.; Liljestrand, R.P.; Ray, L.; Hoffman, G.W.; Madland, D.; Morris, C.L.; Pratt, J.C.; Spencer, J.E.; Thiessen, H.A.; Hintz, N.M.; Kyle, G.S.; Oothoudt, M.A.; Bauer, T.S.; Fong, J.C.; Igo, G.; Ridge, R.J.; Whitten, C.A. Jr.; Kozlowski, T.; McDaniels, D.K.; Varghese, P.; Lang, P.M.; Nann, H.; Seth, K.K.; Glashausser, C. (University of Texas, Austin, Texas 78712). *Phys. Rev. Lett.;* **39**: No. 23, 1447-1450(5 Dec 1977).

Differential cross sections for elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$ have been measured. Preliminary analysis of the data in terms of the Kerman-McManus-Thaler formalism with spin-dependent nucleon-nucleon amplitudes shows sensitivity to details of proton and neutron matter distributions.

**22355** **Definitive test of outgoing-nucleon analog charge exchange using the reactions $^{12}C(\pi^{+-}\ ^{12}C$(4.44 and 15.11 MeV).** Morris, C.L.; Thiessen, H.A.; Braithwaite, W.J.; Moore, C.F.; Bolger, J.E.; Smith, L.E.; Peterson, R.J.; Boudrie, R.L.; Kraushaar, J.J.; Ristinen, R.A.; Smith, G.R. (Los Alamos Scientific laboratory, University of California, Los Alamos, New Mexico 87545). *Phys. Rev. Lett.;* **39**: No. 23, 1455-1457(5 Dec 1977).

Outgoing-nucleon charge exchange has been used to explain reduction in π-N isospin selectivity in a large number of nucleon-removal experiments. The present work tests the validity of this model by measuring the total cross sections for nucleon removal to the 4.44-MeV, T = 0 and the 15.11-MeV, T = 1 states in $^{12}C$, where analog charge exchange is possible for the latter, but not the former state.

**22356** **Measurements of the fusion of $^{12}C$ + $^{14}N$ and the liquid-drop limit for $^{26}Al$.** Stokstad, R.G.; Dayras, R.A.; Gomez del Campo, J.; Stelson, P.H. (Oak Ridge National Lab., Tenn. (USA)); Olmer, C.; Zisman, M.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Phys. Lett., B;* **70**: No. 3, 289-291(10 Oct 1977).

A measurement of the cross section for the fusion of $^{14}N$ + $^{12}C$ has been made at a $^{14}N$ bombarding energy of 248 MeV. The observed value of 717 +- 85 mb is significantly smaller than the value of 936 mb expected on the basis of measurements at lower energies and an entrance-channel model for the fusion process. The experimental critical angular momentum of 27.5 +- 1.7 $\hbar/2\pi$, however, agrees with the prediction of the rotating liquid-drop model, suggesting that the absolute maximum angular momentum which the $^{26}Al$ compound nucleus can sustain has been observed.

## NUCLEAR PROPERTIES AND REACTIONS, A=90-149, THEORETICAL

*REFER ALSO TO CITATION(S) 22369*

### ENERGY LEVELS AND TRANSITIONS

**22357** **Evidence for the coexistence of shapes in even-mass Cd nuclei.** Meyer, R.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.); Peker, L. (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.). *Z. Phys., A;* **283**: No. 4, 379-382(Oct 1977).

A quasi-rotational band built on the known proton four-hole, two-particle $0^+$ level at 1473.07-keV in $^{114}Cd$ has been identified, with $2^+$, $4^+$, and $6^+$ members at 1783.44-, 2250.53- and 2876.75-keV respectively. These levels and their properties are compared with those in other even-mass Cd nuclei to show an increasing average deformation in both the $0^+_1$ (ground-state) and $0^+_2$ bands when neutron pairs are added beyond $^{110}Cd$.

### NUCLEAR REACTIONS AND SCATTERING

**22358** (RLO—2232-T1-4) **Total pion cross section measurements. Annual progress report, January 1, 1975—December 31, 1975.** Jakobson, M.J.; Jeppesen, R.H. (Montana Univ., Missoula (USA)). 6 Jan 1976. Contract EY-76-S-06-2232-001. 10p. Dep. NTIS, PC A02/MF A01.

Pion-nucleus total cross section measurements are continuing for pions of 20 to 250 MeV energy. The initial run was made at the low energy pion (LEP) channel of LAMPF. The second run, delayed due to the extended LAMPF shutdown, is scheduled to begin as soon as LAMPF resumes operation of the LEP channel. During the delay the equipment has been modified, the initial data have been reduced and a theoretical analysis of pion-nucleus scattering undertaken. The cross sections are measured with the usual attenuation method. A DISC counter identifies the pions for energies above 65 MeV and time of flight counters gated with an r.f. signal

from the accelerator identifies the incident pions at lower energies. Data are presented from measurements made during the initial run. They include cross sections from measurements on $^{4}$He between 25 and 105 MeV, on isotope sets ($^{12}$C, $^{13}$C) ($O^{16}$, $^{18}$O) ($^{40}$Ca, $^{44}$Ca, $^{48}$Ca) between 85 and 200 MeV and on 18 nuclei with $4 < A < 208$ MeV. The statistical precision was 2 to 3% for the first run. The statistical accuracy is to be improved and additional targets of $^{6}$Li, $^{7}$Li, $^{10}$B, $^{11}$B and Sc utilized during the second run.

## NUCLEAR PROPERTIES AND REACTIONS, A=90-149, EXPERIMENTAL

### RADIOACTIVE DECAY

*REFER ALSO TO CITATION(S) 22361, 22363*

**22359** (TREE—1115, pp 3-10) **Decay of $^{128}$Cs.** Helmer, R.G.; Reich, C.W.; Gehrke, R.J.; Greenwood, R.C.; Anderl, R.A. Apr 1977.

In Nuclear structure studies utilizing LAMPF. Annual progress report.

Gamma ray energies, intensities, and spectra are reported for $^{128}$Cs and a decay scheme is proposed. (SDF)

**22360** (TREE—1115, pp 14-20) **Decay of $^{134}$La.** Greenwood, R.C.; Reich, C.W.; Helmer, R.G.; Gehrke, R.J.; Anderl, R.A.; Baker, J.D. Apr 1977.

In Nuclear structure studies utilizing LAMPF. Annual progress report.

A continuing study of the $^{134}$La decay to levels in $^{134}$Ba is reported. A summary is given of E2 and EO branching ratio data and reduced transition probabilities for $^{134}$Ba and a level scheme is compared with theory. (SDF)

### ENERGY LEVELS AND TRANSITIONS

*REFER ALSO TO CITATION(S) 22359, 22360*

**22361** (TREE—1115) **Nuclear structure studies utilizing LAMPF. Annual progress report.** Reich, C.W.; Greenwood, R.C.; Helmer, R.G.; Gehrke, R.J.; Heath, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1977. Contract EY-76-C-07-1570. 40p. Dep. NTIS, PC A03/MF A01.

This report summarizes the results of work carried out during Fiscal Year 1976 and the associated Transition Quarter under the program Nuclear Structure Studies Utilizing LAMPF. Separate abstracts appear in ERA for three of the sections herein.

**22362** **Hsub(11/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce.** Gizon, J.; Gizon, A. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires); Diamond, R.M.; Stephens, F.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nucl. Phys., A;* **290**: No. 1, 272-284(24 Oct 1977).

High-spin levels in $^{129}$ $^{131}$Ce have been produced by the reactions $^{116}$ $^{118}$Sn($^{16}$O, 3n)$^{129}$ $^{131}$Ce and studied by in-beam $\gamma$-ray spectroscopic techniques. Two strongly populated band structures are observed. The odd-parity levels based on a $9/2^-$ state constitute a system explained in the triaxial-rotor-plus-particle model as the result of the coupling of an hsub(11/2) neutron-hole to a prolate-type triaxial core. The even-parity band built on a $7/2^+$ state corresponds to collective excitations associated with a neutron-hole in the gsub(7/2) shell. Backbending effect observed in the yrast cascade is discussed.

**22363** **Lifetime of the 376.7-keV level and shape coexistence in $^{111}$Ag.** Glascock, M.D.; Schneider, E.W.; Walters, W.B. (Maryland Univ., College Park (USA). Dept. of Chemistry; Maryland Univ., College Park (USA). Cyclotron Lab.); Meyer, R.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Z. Phys., A;* **283**: No. 4, 415-416(Oct 1977).

The half life of the 376.7-keV level in $^{111}$Ag, populated in the decay of $^{111}$Pd isomers, has been determined to be 16 +- 1 ns. Compton-suppressed $\gamma$-ray spectra and $\gamma\gamma$ coincidence spectra have also been taken. These data, combined with recent charged-particle transfer data establish $3/2^+$ as the spin and parity of the 376.7-keV $^{111}$Ag level. Our observed lifetime and $\gamma$-ray branching can be interpreted as strong indications of shape isomerism in $^{111}$Ag similar to that found in odd-mass In nuclides.

### NUCLEAR REACTIONS AND SCATTERING

*REFER ALSO TO CITATION(S) 22362, 22369*

**22364** **Angular momentum limits in fusion reactions induced by argon and krypton projectiles.** Britt, H.C.; Erkkila, B.H.; Goldstone, P.D.; Stokes, R.H.; Beck, B.B.; Folkmann, F.; Christensen, O.; Fernandez, B.; Garrett, J.D.; Hagemann, G.B.; Herskind, B.; Hillis, D.L.; Plasil, F.; Ferguson, R.L.; Blann, M.; Gutbrod, H.H. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Phys. Rev. Lett.;* **39**: No. 23, 1458-1461(5 Dec 1977).

Evaporation-residue cross sections, A and Z distributions, and $\gamma$-ray multiplicities are reported for $^{40}$Ar and $^{86}$Kr reactions leading to various Er compound nuclei. When combined with previous data the results show an angular momentum limit approximately consistent with the expected onset of fission modified by contributions from charged-particle emission. No evidence is found for an absence of evaporation residues from low-l collisions in the $^{86}$Kr cases.

**22365** **Neutron resonance parameters of $^{90}$Zr below 300 keV.** Musgrove, A.R.L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights); Harvey, J.A.; Good, W.M. (Oak Ridge National Lab., Tenn. (USA)). *Aust. J. Phys.;* **30**: No. 4, 379-389(Aug 1977).

Transmission data taken at both the 80 and 200 m stations of the Oak Ridge Electron Linear Accelerator have provided resonance parameters for $^{90}$Zr to 300 keV bombarding energy. The average s-wave parameter obtained were: $\langle D \rangle = 8.6 +- 1.6$ keV and $S_0 = (0.54 +- 0.14) \times 10^{-4}$, while the average parameters for the two p-wave sequences were: for psub(1/2), $\langle D \rangle = 8.6 +- 1.6$ keV and $S_1 = (3.9 +- 1.0) \times 10^{-4}$, for psub(3/2), $\langle D \rangle = 4.3 +- 0.5$ keV and $S_1 = (4.3 +- 0.8) \times 10^{-4}$.

**22366** **High resolution neutron transmission and capture for $^{91}$Zr.** Musgrove, A.R.L.; Boldeman, J.W.; Allen, B.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights); Harvey, J.A.; Macklin, R.L. (Oak Ridge National Lab., Tenn. (USA)). *Aust. J. Phys.;* **30**: No. 4, 391-400(Aug 1977).

The neutron transmission through $^{91}$Zr was measured at both the 80 and 200 m stations of ORELA and, in combination with a capture measurement at the 40 m station, has resulted in resolved resonance parameters below 20 keV bombarding energy. The average s-wave resonance parameters obtained were as follows: the average level spacing $\langle D \rangle$sub(s) = 640 +- 120 eV, the neutron strength function $10^4$ Ssub(0) = 0.36 +- 0.10 and the average radiative width $\langle \gamma\text{-}\gamma \rangle$sub(s) = 140 +- 8 MeV. For p waves, the average parameters were: $\langle D \rangle$sub(p) = 300 +- 50 eV, $10^4 S_1 = 5.7 +- 1.0$ and $\langle \gamma\text{-}\gamma \rangle$sub(p) = 220 +- 12 MeV. A correlation between p-wave reduced neutron widths and radiative widths is found which is attributed to valence neutron transitions.

**22367** (LA-tr—84) **Proposal for an experimental program at SIN. Study of pion—nucleus scattering using a magnetic spectrometer.** Corfu, R.; Huguenin, P.; Rossel, J.; Schwarz, E.; Olivier, J.C. (Neuchatel Univ. (Switzerland). Inst. de Physique; Schweizerisches Inst. fuer Nuklearforschung, Villigen). 1977. Translation of PR-HE—71-4(Add.4). 10p. Dep. NTIS, PC A02/MF A01.

The proposal for the experimental study of pion--nucleus scattering is considered including the theory, possible experiments, spectrometers, counting rate, other equipment, and the organization and budget. 11 references. (JFP)

## NUCLEAR PROPERTIES AND REACTIONS, A=150-189, EXPERIMENTAL

### RADIOACTIVE DECAY

*REFER ALSO TO CITATION(S) 22368*

### ENERGY LEVELS AND TRANSITIONS

*REFER ALSO TO CITATION(S) 22370*

**22368** (TREE—1115, pp 21-27) **Decay of $^{150}$Tb.** Helmer, R.G. Apr 1977.

In Nuclear structure studies utilizing LAMPF. Annual progress report.

Energies and intensities of gamma rays are tabulated for the decay of $^{150}$Tb (3.1 hr.). (SDF)

**22369** **Experimental study of Yb nuclei at high angular momentum.** Simon, R.S.; Banaschik, M.V.; Diamond, R.M.; Newton, J.O.; Stephens, F.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nucl. Phys., A;* **290**: No. 1, 253-271(24 Oct 1977).

Methods have been developed to study the continuum $\gamma$-ray spectrum following heavy-ion compound-nucleus reactions. In the Yb nuclei studied these spectra were found to depend mainly on the input angular momentum, and not on the target-projectile system. The gross features of the spectra are a high-energy tail of approximately 4 transitions corresponding to the statistical cascade and a lower-energy bump composed of many unresolved collective E2 transitions. Several methods were devised to obtain moment-of-inertia values from the detailed features of this bump for angular momenta as high as $50\ \hbar/2\pi$.

### NUCLEAR REACTIONS AND SCATTERING

*REFER ALSO TO CITATION(S) 22369*

**22370 Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions.** McGowan, F.K.; Milner, W.T.; Sayer, R.O.; Robinson, R.L.; Stelson, P.H. (Oak Ridge National Lab., Tenn. (USA)). *Nucl. Phys., A;* **289**: No. 1, 253-268(10 Oct 1977).

The Coulomb excitation reaction induced by $^{4}$He ions selectively excites $2^+$ and $3^-$ states by direct E2 and E3 Coulomb excitation. In this paper, new results are presented from γ-ray spectroscopy with 15 MeV $^{4}$He ions on a natural abundance target of W. In particular, a $3^-$ state in each isotope, $^{182\ 184\ 186}$W, was observed by direct E3 excitation. In addition to obtaining B(Elambda, $0 \rightarrow J$ = lambda for excitation of each state, information on the reduced transition probabilities for the different decay modes of these states is given. The Coulomb excitation probabilities of the $2'^+$ states at 786 keV in $^{166}$Er and at 737 keV in $^{186}$W were measured with $^{16}$O and $^{4}$He ions by the backscattered particle-gamma coincidence method in order to determine the static electric quadrupole moment Qsub(2'). For $^{166}$Er, Qsub(2')=2.11+-0.37 e.b which is in agreement with (Qsub(2'))sub(rot) and for $^{186}$W, Qsub(2')=1.17+-0.30 e.b which is in agreement with Kumar-Baranger model calculations and is significantly smaller than (Qsub(2'))sub(rot). This deviation of the measured Qsub(2') from (Qsub(2'))sub(rot) implies in the framework of the Kumar-Baranger calculations a strong coupling between β- and γ-vibrational bands. On the other hand, the observed upper limit for B(E2, $2'' \rightarrow 2'$) does not confirm this implication.

## NUCLEAR PROPERTIES AND REACTIONS, A=190-219, THEORETICAL

### NUCLEAR REACTIONS AND SCATTERING

**22371 Successive and simultaneous transfer descriptions of (p,t) reactions on $^{208}$Pb.** Managoli, V. (Manchester Univ. (UK). Dept. of Theoretical Physics); Robson, D. (Florida State Univ., Tallahassee (USA). Dept. of Physics); Charlton, L.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nucl. Phys., A;* **290**: No. 1, 128-140(24 Oct 1977).

Two-neutron transfer via (p,t) transitions to the $0^+$, $2^+$, $4^+$ and $3^+$ states of $^{206}$Pb nucleus are analysed following two independent approaches; one as a leading successive transfer process (p→d→t) corresponding to the recent on-shell method for two-step processes and the other as a leading simultaneous transfer of the DWBA method. Interference effects arising from the inclusion of the singlet state of the deuteron in the p→d→t process are investigated. It is found that the successive transfer mechanism of the on-shell method dominates the forbidden $0^+ \rightarrow 3^+$ transition, whereas the simultaneous transfer of the DWBA approach is totally inadequate. In the case of allowed $0^+ \rightarrow 0^+$, $2^+$ and $4^+$ transitions, however, the simultaneous transfer of the DWBA is seen to provide a better description.

## NUCLEAR PROPERTIES AND REACTIONS, A=190-219, EXPERIMENTAL

### RADIOACTIVE DECAY

**22372 Nuclear data sheets for A=215.** Maples, C. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Nucl. Data Sheets;* **22**: No. 2, 207-221(Oct 1977).

Available information on decay characteristics and level structure for all nuclei with A=215 has been examined. A summary and evaluation of experimental data, including adopted values and comparison with theory are presented. The individual level schemes are discussed, and comments pertaining to adopted spin and parity assignments and to gamma-ray multipolarities are given. Any apparent discrepancies and inconsistencies are pointed out.Much of the level information in the A=215 mass chain is obtained from the a-decay of the A=219 parent nuclei. While a summary of these results is reflected in both the level schemes and in discussions under "Level Properties" and "Gamma-Ray Properties", the actual data are presented under the respective A=219 parent.Decay energies and separation energies have been taken comparison has been made between the adopted a-energies and the input values to the Mass Adjustment.

### ENERGY LEVELS AND TRANSITIONS

**22373 Nuclear data sheets for A=219.** Maples, C. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Nucl. Data Sheets;* **22**: No. 2, 223-242(Oct 1977).

Available information on decay characteristics and level structure for all nuclei with A=219 has been examined. A summary and evaluation of experimental data, including adopted values and comparison with theory are presented. The individual level schemes are discussed, and comments pertaining to adopted spin and parity assignments and to gamma-ray multipolarities are given. Any apparent discrepancies and inconsistencies are pointed out.Much of the level information in the A=219 mass chain is obtained from the a-decay of the A=223 parent nuclei. While a summary of these results is reflected in both the level schemes and in discussions under "Level Properties" and "Gamma-Ray Properties", the actual data are presented under the respective A=223 parent.Decay energies and separation energies have been taken systematically from the 1977 Mass Adjustment (76WaBo, 77Wa08). Detailed comparison has been made between the adopted a-energies and the input values to the Mass Adjustment.

### NUCLEAR REACTIONS AND SCATTERING

**22374 Influence of intrinsic nucleon motion on energy spectra and angular distributions for $^{16}$O-induced reactions at 20 MeV/A.** Gelbke, C.K.; Scott, D.K.; Bini, M.; Hendrie, D.L.; Laville, J.L.; Mahoney, J.; Mermaz, M.C.; Olmer, C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Phys. Lett., B;* **70**: No. 4, 415-417(24 Oct 1977).

Energy spectra and angular distributions for peripheral reactions induced by $^{16}$O on $^{208}$Pb at 20 MeV/A can be explained in terms of the intrinsic nucleon motion of the excited projectile, in a manner similar to the interpretation of projectile fragmentation reactions at 2.1 GeV/A.

## NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, THEORETICAL

### MASS, ABUNDANCE, AND BINDING ENERGY

*REFER ALSO TO CITATION(S) 22310*

### SPONTANEOUS AND INDUCED FISSION

*REFER ALSO TO CITATION(S) 22310*

**22375 Spontaneously fissioning isomers.** Vandenbosch, R. (Department of Chemistry, University of Washington, Seattle, Washington 98195). *Annu. Rev. Nucl. Sci.;* **27**: 1-35(Dec 1977).

Experimental results relating to shape isomers are reviewed. Fission barriers and lifetimes are discussed in some detail.(AIP)

## NUCLEAR PROPERTIES AND REACTIONS, A=220 AND ABOVE, EXPERIMENTAL

### MASS, ABUNDANCE, AND BINDING ENERGY

*REFER ALSO TO CITATION(S) 22310*

### RADIOACTIVE DECAY

**22376 Nuclear data sheets for A=223.** Maples, C. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Nucl. Data Sheets;* **22**: No. 2, 243-274(Oct 1977).

Available information on decay characteristics and level structure for all nuclei with A=223 has been examined. A summary and evaluation of experimental data, including adopted values and comparison with theory are presented. The individual level schemes are discussed, and comments pertaining to adopted spin and parity assignments and to gamma-ray multipolarities are given. Any apparent discrepancies and inconsistencies are pointed out.Much of the level information in the A=223 mass chain is obtained from the a-decay of the A=227 parent nuclei. While a summary of these results is reflected in both the level schemes and in discussions under "Level Properties" and "Gamma-Ray Properties", the actual data are presented under the respective A=227 parent.Decay energies and separation energies have been taken systematically from the 1977 Mass Adjustment (76WaBo, 77Wa08). Detailed comparison has been made between the adopted a-energies and the input values to the Mass Adjustment.

**22377 Nuclear data sheets for A=227.** Maples, C. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Nucl. Data Sheets;* **22**: No. 2, 275-323(Oct 1977).

Available information on decay characteristics and level structure for all nuclei with A=227 has been examined. A summary and evaluation of experimental data, including adopted values and comparison with theory are presented. The individual level schemes are discussed, and comments pertaining to adopted spin and parity assignments and to gamma-ray multipolarities are given. Any apparent discrepancies and inconsistencies are pointed out.Much of the level information in the A=227 mass chain is obtained from the a-

decay of the A=231 parent nuclei. While a summary of these results is reflected in both the level schemes and in discussions under "Level Properties" and "Gamma-Ray Properties", the actual data are presented under the respective A=231 parent. Information concerning the decay of nuclei with A=231 was taken from 71Art1, but the data were verified for correspondence with the more recent evaluation for A=231, 77Sc15.Decay energies and separation energies have been taken systematically from the 1977 Mass Adjustment (76WaBo, 77Wa08). Detailed comparison has been made between the adopted a-energies and the input values to the Mass Adjustment.

### SPONTANEOUS AND INDUCED FISSION

**22378** (HEDL-SA—1148(Rev.1)) **Review of microscopic integral cross section data in fundamental reactor dosimetry benchmark neutron fields.** Fabry, A.; McElroy, W.N.; Kellogg, L.S.; Lippincott, E.P.; Grundl, J.A.; Gilliam, D.M.; Hansen, G.E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1976. Contract EY-76-C-14-2170. 31p. (CONF-761160—2). Dep. NTIS, PC A03/MF A01.

From Consultants meeting on integral cross section measurements in standard neutron fields; Vienna, Austria (15 Nov 1976).

This paper is intended to review and critically discuss microscopic integral cross section measurement and calculation data for fundamental reactor dosimetry benchmark neutron fields. Specifically the review covers the following fundamental benchmarks: the spontaneous californium-252 fission neutron spectrum standard field; the thermal-neutron induced uranium-235 fission neutron spectrum standard field; the (secondary) intermediate-energy standard neutron field at the center of the Mol-ΣΣ, NISUS, and ITN-ΣΣ facilities; the reference neutron field at the center of the Coupled Fast Reactor Measurement Facility; the reference neutron field at the center of the 10% enriched uranium metal, cylindrical, fast critical; the (primary) Intermediate-Energy Standard Neutron Field.

**22379** (RLO/2225/T3—6) **Delayed neutron spectra from $^{232}$Th, $^{233}$U, $^{235}$U, and $^{239}$Pu.** Eccleston, G.W.; Woodruff, G.L. (Washington Univ., Seattle (USA)). 1976. Contract EY-76-S-06-2225-031. 5p. (CONF-760622—63). Dep. NTIS, PC A02/MF A01.

From American Nuclear Society 1976 annual meeting; Toronto, Ontario, Canada (13 Jun 1976).

The near-equilibrium energy spectra of the delayed neutrons associated with fast neutron induced fission of $^{232}$Th, $^{233,235,238}$U, and $^{239}$Pu were measured and are discussed. The spectra for $^{235}$U, similar to the other spectra, are the only results shown graphically. 11 references. (JFP)

## NUCLEAR THEORY

### NUCLEAR REACTIONS AND SCATTERING

**22380** (SLAC-PUB—1601) **New look at the nuclear force.** Noyes, P. (Stanford Linear Accelerator Center, Calif. (USA)). Jul 1975. Contract EY-76-S-03-0326. 4p. Dep. NTIS, PC A02/MF A01.

Nuclear force theory and calculations are discussed. It is noted that whether the quark interpretation or the vague bootstrap ideas indicated turn out to be better approximations, it is hoped that the deuteron problem is on the verge of being turned into the Bohr atom of strong interaction physics. 2 references. (JFP)

**22381** (SLAC-PUB—2010) **Relativistic interactions between nuclei, coherence effects and nonscaling.** Blankenbecler, R.; Schmidt, I.A. (Stanford Linear Accelerator Center, Calif. (USA)). Sep 1977. Contract EY-76-S-03-0326. 29p. (CONF-770697—4). Dep. NTIS, PC A03/MF A01.

From 8. international symposium on multi-particle dynamics; Kaysersberg, France (12 Jun 1977).

The original parton model, in which a hadron is considered to be composed of a number of pointlike constituents called partons, is applied to the nuclear case, incorporating special relativity and nonconservation of particle number. The results of a scattering analysis of heavy ions and nonscaling terms in the theory are then discussed. (SDF)

**22382** **Damped heavy-ion collisions.** Schroeder, W.U.; Huizenga, J.R. (Departments of Chemistry and Physics and Nuclear Structure Research Laboratory). *Annu. Rev. Nucl. Sci.;* **27**: 465-547(Dec 1977).

Macroscopic and microscopic models of heavy-ion nuclear reactions are discussed. Correlations of different experimental parameters are considered.(AIP)

**22383** **Extreme values of spin-polarization analyzing powers in nuclear reactions: M-matrix conditions.** Conzett, H.E.; Seiler, F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nucl. Phys., A;* **290**: No. 1, 93-98(24 Oct 1977).

Sets of linear relations among elements of the transition matrix M are derived for points at which spin-1 and spin-1/2 analyzing power components reach their extreme values.

### RADIOACTIVE DECAY

**22384** **Delayed proton radioactivities.** Cerny, J.; Hardy, J.C. (Department of Chemistry and Lawrence Berkeley Laboratory, Berkeley, California 94720). *Annu. Rev. Nucl. Sci.;* **27**: 333-351(Dec 1977).

The properties of the known $\beta$-delayed proton precursors are given.(AIP)

## RADIATION AND SHIELDING PHYSICS

### RADIATION PHYSICS

*REFER ALSO TO CITATION(S) 22311*

**22385** (SAND—77-1148) **User's manual for the CDC-6600 version of AMPX.** Pickard, P.S.; Vandevender, W.H. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0789. 98p. Dep. NTIS, PC A05/MF A01.

A CDC-6600 version of AMPX-I, the Oak Ridge National Laboratory's modular code system for generating coupled multigroup neutron—gamma libraries from ENDF/B data is described. The AMPX modules can generate multigroup neutron cross sections; generate multigroup gamma cross sections; generate gamma yields for gamma-producing neutron interactions; combine neutron cross sections, gamma cross sections, and gamma yields into "couples sets;" perform one-dimensional discrete-ordinates-transport or diffusion-theory calculations for neutrons and gammas and, on option, collapse the cross sections to broad-group structure, with the one-dimensional results used as weighting functions; and output multigroup cross sections in convenient formats for other codes. 7 figures, 4 tables.

### NEUTRON INTERACTIONS WITH MATTER

*REFER ALSO TO CITATION(S) 22385*

**22386** (ORNL/TM—6108) **Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes.** Gabriel, T.A.; Bishop, B.L. (Oak Ridge National Lab., Tenn. (USA)). Jan 1978. Contract W-7405-ENG-26. 27p. Dep. NTIS, PC A03/MF A01.

The sensitivity of primary knock-on atom (PKA) spectra and displacement per atom (DPA) cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes is investigated. It is shown that the sensitivity of the PKA spectra and DPA cross sections for the (n,n' unresolved) and (n,2n) reactions in Fe to different angular distributions and the same secondary neutron spectrum is reasonably large (approximately 15%), whereas the sensitivity of these quantities to grossly different secondary neutron spectra and the same angular distribution is unexpectedly small. It is also shown that for Al the sensitivity of damage energy cross sections to different "in-group" weighting schemes is, for the most part, small.

**22387** **Multilayer neutron monochromators.** Saxena, A.M.; Schoenborn, B.P. (Brookhaven National Lab., Upton, N.Y. (USA)). *Acta Crystallogr., Sect. A;* **33**: No. 5, 805-813(1 Sep 1977).

Thin-film multilayer monochromators have been fabricated and studied by neutron diffraction. Alternating thin films of two materials, such as Mn and Ge, constitute a one-dimensional crystal owing to the contrast in their scattering amplitude densities. The following are novel features of such a monochromator: (1) large and adjustable d spacing, (2) very high reflectivity, (3) adjustable bandwidth, Δlambda/lambda. Both kinematical and dynamical theories have been developed to give a proper understanding of the properties of a multilayer. Since a deviation from perfect periodicity can have a substantial effect on diffraction properties of a multilayer, a 'disorder factor' has been introduced in the dynamical theory. Finite resolution of the spectrometer has been taken into consideration when the experimental data are compared with the theoretical expressions. These multilayers can also be used as excellent polarizers and filters for neutrons.

**22388** **Correction factors for neutron diffraction from lamellar structures.** Saxena, A.M.; Schoenborn, B.P. (Brookhaven National Lab., Upton, N.Y. (USA)). *Acta Crystallogr., Sect. A;* **33**: No. 5, 813-818(1 Sep 1977).

In a spectrometer with finite beam divergence the vertical size of the reflections will increase with the order of reflection. This effect will be more pronounced if the mosaic width of the sample is

large, which is often the case with biological samples. When the size of the reflection is greater than the detector size, a correction factor has to be introduced to account for this loss of intensity. A method of calculating this correction factor for a given beam divergence and mosaic width has been developed.

**22389 Calculational tool for neutron propagation in steel and sodium media for fast reactor shielding applications.** Bouteau, F. (Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les Durance, France); Caumette, P.; Devillers, C.; Khairallah, A.; Oceraies, Y. pp 148-157 of In Proceedings of the specialists's meeting on sensitivity studies and shielding benchmarks. Paris; Organization for Economic Co-operation and Development (1975). (In French)

From Specialists' meeting on sensitivity studies and shielding benchmarks; Paris, France (7 Oct 1975).

See CONF-751063—.

The simplified calculational tool ("formulary") for neutron propagation in the shields of fast reactors, being developed at CEA, has two objectives: to reduce the cost of the major part of design calculations without a significant loss of accuracy, to facilitate the adjustment of the calculational tool with the results of the program of integral propagation experiments, which is conducted in parallel with the development of the calculational method. The "version O" (i.e., before any adjustment) of the "formulary" is presented as a first test of its validity as compared to the results of integral measurements.

## MEDICAL PHYSICS

### DOSIMETRY

**22390** (UCID—17669) **DT fusion neutron irradiation of LLL niobium.** MacLean, S.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Jul 1977. Contract W-7405-ENG-48. 5p. Dep. NTIS, PC A02/MF A01.

The DT fusion neutron irradiation of June 14 to 16, 1977 is briefly outlined by the neutron dose record and the neutron fluences on 16 dosimetry foils.

## SOLID STATE PHYSICS

**22391 Formal approach to various properties of antiferromagnets.** Goldstein, L.; Goldstein, J.C. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico). *J. Low Temp. Phys.;* **29**: No. 5, 587-614(Dec 1977).

The formal representation of thermal and magnetic properties of moderately anisotropic antiferromagnets in the presence and absence of a constant, uniform external magnetic field is discussed both in selective ordered configurations and in the paramagnetic phase. The mean-field-theoretical formalism is shown to give a satisfactory account of the magnetic properties of a class of two-sublattice antiferromagnets in those ordered configurations where the applied magnetic field is at a right angle to the direction of the spontaneously evolving sublattice magnetic moments. Predictions of mean-field theory on the linearity of the magnetic moment in the applied field strength and the attendant invariant molar susceptibility throughout the relevant portions of the configuration phase diagrams, phase-boundary lines included, are seen to be well satisfied. This is verified in detail on the typical antiferromagnet $MnCl_2x4H_2O$, where the $Mn^{2+}$ ions in their $^6$S/sub 5/2/ ground state determine the magnetic properties and fwhich numerous magnetic and thermal measurements have been accumulated in both the ordered and paramagnetic phases. In contrast with the magnetic properties, mean-field theory is less successful in accounting for the thermal properties of antiferromagnets, but its qualitative predictions agree well with the observations. In the paramagnetic phase, the isotropic nearest-neighbor exchange-coupled model system is used. Here the formal approach corresponds to a series expansion of the various properties in ascending powers of J/kT, in the absence of magnetic field, with an additional magnetic-field-exchange double series in the presence of an external field. In those temperature and field-strength regions where convergence is satisfactory, the above approach is shown to give a good account of the observed thermal properties of the manganese compound in the absence of magnetic field, as well as of the low-field paramagnetic susceptibility

**22392 Diffusion of light particles in metals.** Seeger, A. (Max-Planck-Institut fuer Metallforschung, Stuttgart (Germany, F.R.)); Teichler, H. (Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Theoretische und Angewandte Physik). pp 217-254 of In 19. Colloquium on metallurgy. Diffusion in condensed mediums. Theory and applications. Saclay, 22-25 June 1976. Vol. 1. Gif-sur-Yvette, France; Institut National des Sciences et Techniques Nucleaires (1977).

From 19. colloquium on metallurgy. Diffusion in condensed mediums. Theory and applications; Saclay, France (22 Jun 1976).

See CONF-7606124—.

The positively charged light particles as positron, positive muon, proton, deuteron and triton may be considered as isotopes of the element with atomic number one. Thus they offer unique opportunities for studying isotope effects in the regime of 'quantum diffusion'. The basic properties of these particles are reviewed and related to recent experiments on muon depolarization and positron annihilation. The question is whether positrons may show the phenomenon of self-trapping in metals. Recent developments in the quantum theory of diffusion of self-trapped particles are discussed in detail.

**22393** (UCRL-Trans—11291) **Stepwise deformation.** Classen-Nekludowa, M. Translated from *Z. Phys.;* **55**: No. 7-8, 555-568(1929). 21p. Dep. NTIS, PC A02/MF A01.

The mechanism of crystal flow beyond the yield point was studied. The deformation of rock salt (pure shear) at high temperature was measured with a recording apparatus having 10,000X expansion factor. It was found that deformation occurs in steps, each step being around a few thousandths of a millimeter. In the interval between two steps, which can last for several seconds, the deformation rate is zero for the entire crystal. The stepwise deformation has highly regular character and is accompanied by a very regular cracking noise reminiscent of the ticking of a clock. Similar studies were also carried out on metals. Stepwise deformation was observed in monocrystalline and polycrystalline brass and in polycrystalline aluminum. The deformation pattern for single crystals and polycrystals proved to be the same and identical to that found for rock salt. Simultaneous examination of the microstructure of the deformed specimens showed that a polycrystalline zone formed in the shear plane in the single crystal. When flat Duraluminum specimens were stretched, formation of slip lines (Luder's lines) was observed. This phenomenon is also accompanied by a cracking noise.

## SUPERCONDUCTIVITY

### GENERAL THEORY

**22394 Role of electronic excitations with energy distribution in local nonequilibrium in increasing T/sub c/.** Karas', V.I.; Moiseev, S.S.; Novikov, V.E.; Seminozhenko, V.P. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 6, 336-341(Jun 1977).

Using a system of integral equations for the nonequilibrium gap Δ/sub k/ in the quaisparticle energy spectrum and the energy renormalization function Z/sub k/, the question of superconductivity enhancement (increase in superconductive transition temperature T/sub c/) due to creation of nonequilibrium distributions of electron excitations is considered. It is shown that a new enhancement mechanism exists, based on pumping of excitations into the Debye frequency region.

**22395 Tunnel contacts in superconductors with a paramagnetic impurity.** Moskalenko, V.A.; Nika, Y.N. (Applied Physics Institute, Academy of Sciences of the Moldavian SSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 6, 341-346(Jun 1977).

It is shown that a paramagnetic impurity eliminates logarithmic divergences and amplitude discontinuities in the tunnel current through a contact formed by superconductors separated by a dielectric film. The presence of the impurity leads to the disappearance of singularities in the first derivatives of the amplitudes of Josephson, quasiparticle, and interference currents, although the second derivatives retain the singularities characteristic of pure superconductors. The relationship between several tunnel characteristics and kinetic characteristics of massive superconductors is demonstrated. The current amplitudes are calculated at the low impurity concentration limit for a voltage across the contact equal to ω/sub g/ +- ω/sub g/ ', where ω/sub g/ is the energy gap.

**22396 Effect of electron-phonon scattering on collective excitations in "dirty" superconductors.** Cheishvili, O.D. (Institute of Physics, Academy of Sciences of Georgian SSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 6, 357-361(Jun 1977).

The effect of inelastic electron scattering by intrinsic oscillations of the order parameter in "dirty" superconductors is investigated for a wide temperature range. It is shown that near the transition temperature ($\Delta^2_0$(T)/T/sub c/very-much-less-than$\tau_0^{-1}$very-much-less-than$\Delta_0$(T, where $\tau_0$ is the inelastic electron scattering time) the damping of collective excitations of the phase of the order parameter, having the form of a propagating wave, is determined by the inelastic scattering time.

**22397 Ginzburg-Landau equations and quantum coherent phenomena in systems with electron-hole pairing.** Shevchenko, S.I. (Physicotechnical Institute of Low Temperatures, Academy of Sciences of the Ukrainian SSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 5, 293-302(May 1977).

A Ginzburg-Landau scheme is developed to describe nonuniform states of systems with pairing of spatially separated electrons and holes. The equations obtained are used to study current-carrying states in such systems. It is shown that electron tunneling from regions of electron to regions of hole conductivity does not suppress the flow of persistent currents. A new mechanism of superconductivity is predicted which is associated with degeneracy of layered structures of the type under consideration in the longitudinal velocity of electron-hole pairs. This mechanism is manifested in transverse superconductivity near the surface of the layered crystal.

**22398 Strength of an ideal vortex lattice in a superconductor.** Tkachenko, V.K. (Institute of Solid-State Physics, Academy of Sciences of the USSR). *Sov. J. Low Temp. Phys. (Engl. Transl.);* **3**: No. 5, 303-304(May 1977).

The vortex lattice in a type II superconductor near H/sub c2/ is analyzed. The maximum deformation of a triangular lattice at which the lattice retains stability against long-wave perturbations is calculated. A hypothesis concerning a Gaussian vortex interaction is advanced.

### ACOUSTIC, ELECTRIC, MAGNETIC, OPTICAL, AND THERMAL PHENOMENA

*REFER ALSO TO CITATION(S) 21885, 21887, 21888*

## THEORETICAL PHYSICS

### CLASSICAL AND QUANTUM MECHANICS

**22399 Computation of cubic harmonics.** Fox, K.; Krohn, B.J. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *J. Comput. Phys.;* **25**: No. 4, 386-408(Dec 1977).

Symmetry-adapted functions (orthonormal linear combinations of angular-momentum eigenfunctions belonging to particular symmetry species) for the T/sub d/ and O/sub h/ point groups have been computed for J< or =100 using an algorithm of Fox and Ozier, and Cholesky factorization of idempotent matrices. The results of Cholesky factorization are compared with those of both symmetric elimination with pivoting and an EISPACK diagonalization routine.

### OPTICS

*REFER ALSO TO CITATION(S) 22029*

### STATISTICAL PHYSICS AND THERMODYNAMICS

**22400 Consequence of the invariance of Biot's variational principle in thermal conduction.** Lonngren, K.E.; Hsuan, H.C.S. (Mathematics Research Center, University of Wisconsin, Madison, Wisconsin 53706). *J. Math. Phys. (N.Y.);* **19**: No. 2, 357-358(Feb 1978).

The invariance of Biot's variational principle in thermal conduction suggests that this variational principle can be formulated in terms of a self-similar variational principle. This work presents such a derivation and applies it to a thermodynamics example.

## MATHEMATICAL PHYSICS

*REFER ALSO TO CITATION(S) 22399*

**22401 Comments on the comparison of global methods for linear two-point boundary value problems.** de Boor, C.; Swartz, B. (Mathematics Research Center, University of Wisconsin in Madison, Wisconsin 53706). *Math. Comput.;* **31**: No. 140, 916-921(Oct 1977).

A more careful count of the operations involved in solving the linear system associated with collocation of a two-point boundary value problem using a rough splines reverses results recently reported by others in this journal. In addition, it is observed that the use of the technique of "condensation of parameters" can decrease the computer storage required. Furthermore, the use of a particular highly localized basis can also reduce the setup time when the mesh is irregular. Finally, operation counts are roughly estimated for the solution of certain linear system associated with two competing collocation methods; namely, collocation with smooth splines and collocation of the equivalent first order system with continuous piecewise polynomials.

**22402 Roots of two transcendental equations determining the frequency spectra of standing spherical electromagnetic waves.** Pexton, R.L.; Steiger, A.D. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *Math. Comput.;* **31**: No. 140, 1000-1002(Oct 1977).

Roots of the transcendental equations j/sub l/(λ)/y/sub l/(λ) =j/sub l/(αλ) i/sub l/ (a)/i/sub j/(a)-j/sub l/(αλ)/√vertical-bar∈vertical-bar]/[y/sub l/ (αλ) i/sub l/(a)/i/sub l/(a)-y/sub l/ (αλ)/√vertical-bar∈vertical-bar]/a=αλ√vertical-bar∈vertical-bar and [etaj/sub l/(eta)-lj/sub l/(eta)]/[etay/sub l/ (eta)-ly/sub l/ (eta)]=vertical-bar∈vertical-barβj/sub l/(β)/(1+vertical-bar∈vertical-bar) -lj/sub l/(β)+√vertical-bar∈vertical-barβj/sub l/ (β) i/sub l/ (b)/(1+vertical-bar∈vertical-bar) i/sub l/(b)]/[vertical-bar∈vertical-barβy/sub l/ (β)/(1+vertical-bar∈vertical-bar)-ly/sub l/(β)+√vertical-bar∈vertical-barβy/sub l/(β) i/sub l/(b)/(1+vertical-bar∈vertical-bar) i/sub l/(b)]/β =αeta/b=β√vertical-bar∈vertical-bar for the spherical Bessel functions of the first and second kind, j/sub l/(x) and y/sub l/(x), and for the modified spherical Bessel functions of the first kind, i/sub l/(x), have been computed. The ranges for the parameters √vertical-bar∈vertical-bar and α, the order l and the root index n are: √vertical-bar∈vertical-bar=1.0, 10.0 100.0, 500.0; α=0.1(0.1)0.7; λ=1(1)15; n=1(1)30.

## COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY

**22403** (PUB—113(Vol.3)) **Travels in the new world. Volume III.** Seaborg, G.T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1977. Contract W-7405-ENG-48. 336p. Dep. NTIS, PC A15/MF A01.

This is the third volume of a three-volume series, Travels in the New World, describing the visits of Glenn J. Seaborg to some 60 countries during his tenure as Chairman of the US Atomic Energy Commission during the decade 1961—1971. Although nuclear energy is prominent, the theme is broader than this in its emphasis on international cooperation in science and technology and on efforts to promote the Non-Proliferation Treaty (NPT). This volume describes four visits to the Soviet Union, two reciprocal visits of Soviet colleagues to the United States, and numerous negotiations and other exchange visits between the two countries during this period of time. It is hoped that this will give the reader some insight into relations during this decade. Some narrative material is interspersed in order to help the reader understand the journal entries, some of which are rather brief. (RWR)

# FUSION ENERGY

## PLASMA RESEARCH

### PLASMA CONFINEMENT AND HEATING

*REFER ALSO TO CITATION(S) 22627*

**22404** (CONF-771109—85) **Fusion-fission analogy.** McNally, J.R. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 6p. Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

The analogy of plasma ignition of fusion devices to criticality in fission systems is shown. The four-factor formula is presented and special emphasis is given to the energy utilization factor, which now dominates fusion research. Instead of keeping books on neutrons, as in the fission case, the fusion case follows the plasma energy density. (MHR)

**22405 Magnetic field reversal induced by an intense rotating electron beam in an initially neutral gas.** Roberson, C.W.; Tzach, D.; Rostoker, N. (Department of Physics, University of California, Irvine, California 92717). *Appl. Phys. Lett.;* **32**: No. 4, 214-216(15 Feb 1978).

We find field reversals up to four times the initial field and changes in the magnetic field on the axis of symmetry of 6 kG when a rotating electron beam is injected through a cusp into an initially neutral gas. The change in magnetic field on the axis was found to be independent of the magnetic field. This is shown to be consistent with measurements that the cusp transmission coefficient times the ratio of the azimuthal velocity (V/sub theta)/to the axial velocity (V/sub z/) is independent of magnetic field.

**22406 Formation of strong E-layers by intense electron-beam injection into preformed plasmas.** Smith, A.C. Jr.; Fleischmann, H.H.; Condit, W.C. Jr. (School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14853). *Appl. Phys. Lett.;* **32**: No. 3, 133-136(1 Feb 1978).

Intense electron-beam injection into preformed plasmas in the RECE-Berta and CHIP devices at Cornell led to the formation of electron layers with 25 and 80% field-reversal strength, and lifetimes

of 400 and 150 μsec, respectively. A pronounced "stalling" of the beam in the vicinity of the injector is observed in RECE-Berta.

**22407 Observations of cyclotron radiations from turbulently heated plasmas (the MACH II).** Iguchi, H.; Ito, Y.; Kawabe, T.; Mase, A.; Tsukisima, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics). *Phys. Lett., A;* **62**: No. 5, 343-346(5 Sep 1977).

Cyclotron radiations at an electron cyclotron and its second harmonics frequencies were observed from a turbulently heated plasma in a strong magnetic field. The cyclotron radiations were emitted when the plasma became resistive and the electron temperature was increased. An appreciable effect of an enhanced collision of electrons in the turbulent plasma was observed on the line width.

**22408 Heating and ionization in MHD switch-on shocks in partially ionized plasmas.** Bighel, L.; Collins, A.R.; Cramer, N.F. (Sydney Univ. (Australia). School of Physics). *J. Plasma Phys.;* **18**: 77-89(Aug 1977).

The structure of MHD switch-on shocks propagating along a magnetic field into an upstream partially ionized plasma is studied experimentally and theoretically. Detailed measurements of density, temperature and magnetic field are presented, and compared with a model based on the fluid equations for electrons, ions and neutral atoms. The main feature of the model is that dissipation of shock energy occurs primarily through ion collisions with neutrals. According to the model, at low upstream ionization levels, ions and neutrals are preferentially heated above the electrons. At high ionization levels, the electrons are more strongly heated. This is found to be in agreement with the shock structures obtained for 4 switch-on shocks, differing in the level of upstream ionization.

**22409 Cyclotron masers (gyrotrons) as potent millimetre-wave sources.** Hirshfield, J.L.; Granatstein, V.L. *Comments Plasma Phys. Controlled Fusion;* **3**: No. 3, 87-93(Aug 1977).

A review is presented of the development of cyclotron maser devices as millimetre-wave sources and their applications in plasma heating as well as in conventional microwave technology, including radar.

**22410 Containment of an adiabatic plasma on magnetic lines of force by a self-generated electrostatic field.** Hruska, A. (National Research Council of Canada, Ottawa, Ontario). *Astrophys. Space Sci.;* **50**: No. 1, 153-161(Aug 1977).

One component of a three-fluid adiabatic plasma is under certain conditions contained in a restricted region of space by a large-scale electrostatic field generated within the plasma. The containment is discussed here for plasma consisting of ions and two populations of electrons characterized by different pitch angle distribution functions. The 'bouncing' motion of electrons along 'open' fieldlines between a magnetic mirror and an 'electrostatic' mirror produces a velocity distribution function similar to that generated by 'bouncing' particles on 'closed' fieldlines.

**22411 Lagrangian description of flute drift turbulence of θ-pinch plasma.** Bol'shov, L.A.; Dreizin, Y.A.; Dykhne, A.M. *JETP Lett. (USSR) (Engl. Transl.);* **26**: No. 1, 4-7(5 Jul 1977).

Two-fluid hydrodynamics is used to derive a system of equations suitable for the description of advanced drift fluxes of particles and the energy in a θ-pinch plasma. A general stability criterion is obtained for an inhomogeneous plasma in a straight field relative to drift oscillations of the flute type. The nonlinear regime is investigated qualitatively.

**22412 Ion temperature scaling on Jaeri tokamaks.** Takeuchi, H.; Funahashi, A.; Takahashi, K. (Jpn At Energy Res Inst, Tokai, Ibaraki). *Jpn. J. Appl. Phys.;* **16**: No. 7, 1227-1233(Jul 1977).

The dependence of the ion temperature on various parameters (line-averaged electron density, plasma current, and toroidal magnetic field was investigated for the JAERI-tokamak devices JFT-2 and JFT-2a with a 10-channel neutral particle energy analyzer. The measurements were performed by keeping two of the three parameters nearly constant, and was shown that the ion temperature obeys the one-third power law in all three parameters. 12 refs.

**22413 High-current pinches in xenon. II. Z pinch.** Andreev, S.I.; Baikov, O.G.; Dashuk, P.N.; Popov, P.G. *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 691-695(Jun 1977).

A continuous cylindrical plasma shell is produced at initial xenon pressures up to 760 torr through the use of a grazing discharge along the inner surface of the discharge chamber. Under conditions such that the initial collapse velocity of the plasma ring is above 4 km/sec, the gaskinetic pressure is negligible compared with the magnetic pressure, and the discharge occurs in the magnetogasdynamic regime. At collapse velocities below 2 km/sec the gaskinetic pressure dominates, and the discharge occurs in the gasdynamic regime. Comparison of Θ and Z pinches under identical conditions shows that when the ratio of the length of the discharge chamber to the chamber diameter does not exceed two the Θ pinch yields more efficient plasma heating. Brightness temperatures up to 13,000°K in the visible region are achieved at a current rate of rise of $\sim 5 \times 10^{11}$ A/sec in a plasma layer 10 cm in diameter and 14 cm long. It is noted that similarity methods cannot be applied to radiating discharges.

**22414 Quasi-linear relaxation of runaway electrons in a hf heated tokamak plasma.** Klima, R.; Parail, V.V. (Inst of Plasma Phys, Czech Acad of Sci, Prague). *J. Plasma Phys.;* **17**: 543-551(Jun 1977).

The theory of quasilinear diffusion of runaway electrons in the field of electromagnetic waves (HF field) excited by external sources is given. The frequency of the waves is somewhat less than the electron cyclotron frequency. The time-averaged distribution function of resonant electrons is derived. The presence of the toroidal electric field changes the process of quasilinear relaxation considerably. It also leads to a continuous absorption of energy and momentum from the HF field. On the other hand, the HF field increases the number of high-energy electrons. As a consequence, beam instabilities can arise. A comparison with experimental results is given. 8 refs.

**22415** (ORNL-tr—4537) **Effectiveness of interaction of an electron flux with high $v/\gamma$ with preliminary heating of a plane target.** Gribkov, V.A.; Dubrovskii, A.V.; Isakov, A.I.; Kozlova, T.A.; Krokhin, O.N.; Nikulin, V.Ya.; Semenov, O.G.; Sklizkov, G.V. Translated by S.D. Blalock, Jr. from *Pis'ma Zh. Eksp. Teor. Fiz.;* **26**: No. 4, 322-327(1977). 6p. Dep. NTIS, PC A02/MF A01.

It is shown that preliminary heating of a solid target leads to an increase in the coefficient of absorption of the flux of relativistic electrons. The work was done on the "plasma focus" installation with a battery energy of 50 kJ, a charge voltage of 27 kV, and filled with deuterium at a pressure of 0.5 torr. (MHR)

**22416** (ERDA-tr—316) **Collective processes in the case of injection of rapid neutral atoms in a tokamak with noncircular cross section.** Sardakov, V.M.; Mikahylovskii, A.B. Translated from *Fiz. Plazmy;* **3**: No. 2, 220-229(1977). 16p. Dep. NTIS, PC A02/MF A01.

A study is made of collective processes which may occur in the case of injection of a beam of rapid neutral atoms in a Tokamak with noncircular cross section. It is assumed that these processes are connected with the buildup of Alfven waves by rapid ions which are formed during the ionization of neutral atoms. A calculation is made of the linear increment. Alfven waves increase in a Tokamak noncircular cross section, allowing for the poloidal dependence of the poloidal magnetic field. A problem of the O'Neil type is solved for the noncircular Tokamak. Equations are obtained which describe the quasi-linear relaxation of rapid ions in a Tokamak of noncircular cross-section. The conclusion is reached that the non-circular nature of the cross section may cause additional branches of instabilities and additional non-Coulomb relaxation processes.

**22417 Alpha particle effects on the reversal field mirror.** Wang, M.Y.; Miley, G.H.; Wang, L.S. (Univ. of Illinois, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 93-94(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22418 Wave absorption in plasma at the ion-hybrid resonance.** Dnestrovskii, Yu.N.; Kostomarov, D.P.; Pereverzev, G.V.; Pogosyan, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Moskovskij Gosudarstvennyj Univ. (USSR)). *Fiz. Plazmy;* **1**: No. 4, 623-634(Jul 1975). (In Russian).

The problem of plasma heating by HF waves has been studied by many authors in the last years. In real conditions of an experiment when the SHF energy is delivered with the help of loops and waveguides, an extremely wide spectrum of oscillations over m and Ksub(z) may be excited. In this case due to the resonance character of absorption the fraction of energy delivered to a plasma may be small. The numerical analysis made shows that for an efficient pumping of energy into a plasma it is sufficient to choose carefully both the frequency of oscillations and the geometry of radiating antennae.

## PLASMA DIAGNOSTICS

*REFER ALSO TO CITATION(S) 22121*

**22419** (CONF-770954—5) **Status of the USA program on the development of submillimeter lasers to measure ion temperatures.** Barnett, C.F.; Hutchinson, D.P.; Vander Sluis, K.; Staats, P.A. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 10p. Dep. NTIS, PC A02/MF A01.

From 2. conference on hot plasma diagnostics; Kharkov, USSR (22 Sep 1977).

The concept of ion laser scattering is outlined briefly and the parameters of the required submillimeter laser system are described. The current state of the development of lasers, laser and viewing dumps, and detectors is reviewed. (MHR)

**22420** (PPPL—1394) **Measurements of the parametric decay of $CO_2$ laser radiation into plasma waves at quarter critical density using ruby laser Thomson scattering.** Schuss, J.J.; Chu, T.K.; Johnson, L.C. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Nov 1977. Contract EY-76-C-02-3073. 16p. Dep. NTIS, PC A02/MF A01.

We report the results of small-angle ruby laser Thomson scattering measurements of the parametric excitation of plasma waves by $CO_2$ laser radiation at quarter-critical density in a laser-heated gas target plasma. From supplementary data obtained from interferometry and large-angle ruby laser scattering we infer that the threshold conditions for a convective decay are satisfied.

**22421** (SAND—77-1829C) **Discussion of diagnostics techniques in particle beam fusion at Sandia Laboratories.** Kuswa, G.W. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 8p. (CONF-770954—4). Dep. NTIS, PC A02/MF A01.

From 2. conference on hot plasma diagnostics; Kharkov, USSR (22 Sep 1977).

A brief introduction is given to techniques which are of special use to the particle beam fusion program. Beam, machine, and target diagnostics are discussed. (MHR)

**22422** (UCID—17650) **Diagnostic programs used with McGUS a 3D mirror equilibrium code.** Boyd, J.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Oct 1977. Contract W-7405-ENG-48. 52p. Dep. NTIS, PC A04/MF A01.

There are currently five diagnostic programs used to process various McGUS equilibrium results. This report describes the purpose and operating procedures of each of these codes.

**22423** (UCRL—52339) **Detection and measurement of Post-Rosenbluth convective instability in MFTF with a hybrid $CO_2$ laser—heterodyne diagnostic system.** Peratt, A.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Oct 1977. Contract W-7405-ENG-48. 19p. Dep. NTIS, PC A02/MF A01.

To measure and classify the Post-Rosenbluth convective loss-cone instability in MFTF, we propose to use a $CO_2$ laser consisting of a TEA-pulsed section and a low pressure CW section, together with a light mixing receiver. Calculations show that this system offers sufficient power and sensitivity to detect instability throughout the range from strong coherent light scattering to weak incoherent scattering when the instability is eliminated.

**22424** (UCRL—79780) **Pinhole imaging of laser-produced thermonuclear alpha particles.** Brooks, K.M.; Ceglio, N.M.; Slivinsky, V.W.; Ahlstrom, H.G.; Storm, E.K.; Kornblum, H.N.; Leipelt, G.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Nov 1977. Contract W-7405-ENG-48. 12p. (CONF-771136—18). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

Results of pinhole images of thermonuclear alpha particles generated by exploding pusher targets in the Argus laser facility are reviewed. Recorded images indicate that the reactions occur within a 25 to 30 micron region with twelve micron resolution for ten micron pinholes and thirty micron resolution for twenty-five micron pinholes. These results are in good agreement with LASNEX computer predictions and are confirmed by Zone Plate imaging of the burn conducted by Natale M. Ceglio at LLL. Planned three-dimensional imaging of the burning D-T gas in the Shiva laser facility using seven micron pinholes is discussed. Higher yields (approximately $5 \times 10^{10}$ reactions) and three orthogonal images of the burn will provide a data base for analysis using an Algebraic Reconstruction Technique to provide a higher resolution (9 micron), three-dimensional view of the burn.

**22425** (UCRL—79782) **Sub-keV, subnanosecond measurements of x-ray spectra from laser-produced plasmas.** Kornblum, H.N.; Koppel, L.N.; Slivinsky, V.W.; Glaros, S.S.; Ahlstrom, H.G.; Larsen, J.T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1977. Contract W-7405-ENG-48. 12p. (CONF-771136—16). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

As part of the effort to extend our x-ray diagnostic capabilities, we have made x-ray spectral measurements of laser-produced plasmas for photon energies down to 100 eV with a time response of 0.5 nsec. Fast, windowless x-ray diodes were used in conjunction with critical angle reflecting mirrors and thin filters for energy definition for two channels, 300 to 600 eV and 800 to 1300 eV. A third channel, using only an x-ray diode and filter, provided spectral information in the 100 to 300 eV region. Results from exploding pusher targets will be presented and compared with those of other diagnostic techniques and Lasnex calculations. Future expansion and modifications of the present system will be discussed.

**22426** **Interferometry and luminosity measurements on a $CO_2$ laser plasma focus.** Saint-Hilaire, G.; Szili, Z. (Direction Sciences de base, Institut de recherche de l'Hydro-Quebec, Varennes, Quebec, Canada J0L 2P0). *J. Appl. Phys.;* **49**: No. 1, 103-106(Jan 1978).

This paper presents an interferometry study of a $CO_2$ laser plasma focus created in a 1-cm copper annular target. The average electron density measured on the plasma axis is approximately n/sub e/$\sim 1.6 \times 10^{18}$ cm$^{-3}$. Spatial and temporal plasma luminosity measurements suggest a simple model for the plasma motion. This laser-produced plasma has an axis and a plane of symmetry which make it an interesting subject for further studies on laser plasma interactions.

**22427** **Spatially resolved EUV emission from focused REB discharges into thin targets.** Johnson, D.J.; Oliphant, W.F.; Doschek, G.A.; Feldman, U. (Plasma Physics Division, Naval Research Laboratory, Washington, D.C. 20375). *J. Appl. Phys.;* **49**: No. 1, 113-120(Jan 1978).

The EUV emission from 10- to 100-mg/cm$^2$-thick planar targets (Z=6—79) exposed to 60-nsec-duration focused relativistic electron beams was examined at current densities of 0.4—1.0 MA/cm$^2$. Spatially resolved spectra were obtained with a stigmatic near-normal incidence spectrograph, in the wavelength range 500—2100 A, along axial and radial directions. Time-resolved EUV data were obtained with windowless photoelectric diodes operated unfiltered and filtered with 0.5-μm-thick aluminum. The axial views show copious emission from the diode gap associated with late-time impedance collapse. Radial views show continuum radiation which is emitted from the region of the target exposed to the focused REB and line radiation which originates from a lower-density (approximately $10^{19}$ cm$^{-3}$) more-extended late-time plasma resulting from foil expansion. The region of the foil exposed to the focused REB radiates as a blackbody source with a peak temperature of 2—6 eV. These temperatures are a factor of 2 below the calculated temperatures for classical deposition in the foils exposed to the focused beam assuming no hydrodynamic foil expansion.

**22428** **Particle and x-ray energy measurements in laser-plasma interaction experiments.** Rupert, V.C.; Gunn, S.R.; Holzrichter, J.F. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *J. Appl. Phys.;* **49**: No. 1, 132-137(Jan 1978).

The energy carried by particles and low-energy x rays resulting from irradiation of laser fusion targets with 0.5—1-TW 1.06-μm lasers has been measured. The energy distributions were obtained from measurements at discrete locations using plasma calorimeters. The data have been integrated to obtain the absorbed energy, and these values compared to scattered-light calorimetry and optical-energy balance.

**22429** **Theoretical analysis on radiation and reception characteristics of an oblate spheroidal antenna for electron plasma waves.** Ohnuki, S.; Adachi, S.; Ohnuma, T. (Department of Electrical Engineering, Tohoku University, Sendai, 980 Japan). *J. Appl. Phys.;* **49**: No. 1, 138-145(Jan 1978).

The radiation and reception characteristics of the oblate spheroidal antenna for electron plasma waves are theoretically investigated. The analysis is carried out as a boundary-value problem. The formulas for the radiation and reception characteristics such as radiation impedance, electron charge distributions, radiated wave potential, directional properties, and receiving voltage of the oblate spheroidal antenna are analytically obtained. As a result, it is concluded that the radiation and reception characteristics of the antennas are not uniquely determined by k/sub p/a (k/sub p/ is the wave number of an electron plasma wave, and a is the radius of the circular-plate antenna), but are determined by two out of three factors, k/sub p/a, zeta (radius divided by Debye length), and ω/ω/sub p/ (angular signal frequency to angular plasma frequency). This conclusion is in marked contrast to the conventional theory in which the charge distribution on the antenna is assumed a priori as uniform and, thus, the antenna characteristics are uniquely determined by k/sub p/a. It is claimed that the experimental results obtained hitherto support the present new theory.

**22430** **Diagnostics of an rf induction plasma torch with the aid of a magnetic probe.** Shamim, A.; Wooding, E.R. (Royal Holloway College, Egham, Surrey, United Kingdom). *J. Appl. Phys.;* **49**: No. 1, 460-461(Jan 1978).

Estimates of a plasma temperature, electrical conductivity, and torch efficiency have been made from simple measurements made on the plasma and on the rf supply. Measurements were made with the aid of a simple magnetic probe and a pickup coil. Estimates are also made of the heating-coil constants.

**22431** (UCRL-Trans—11298) **High-speed image converters for studying laser radiation with picosecond and femtosecond time resolution.** Bryukhnevich, G.I.; Vorob'ev, H.S.; Shchelev, M.Ya. Nov 1977. Translation of Preprint No. 31, AN SSSR, Fizicheskii Institut imeni P.N. Lebedeva, Moskva, 1977. 23p. Dep. NTIS, PC A02/MF A01.

On the basis of the experiments performed and theoretical estimates, the chief methods for modernizing multistage image converters (IC) of type PIM-UMI in the direction of an appreciable

increase of their time and space resolution in the linear scanning mode are formulated. The principal models of high-speed IC used for studying lasers and laser plasma are described. The method of recording sinusoidally modulated laser radiation for measuring the dynamic characteristics of IC has been developed further. Specific features of the circuits of dual-frequency neodymium lasers are discussed. Individual results of measurement of the temporal modulation transfer function of the converters studied are presented. Plans for further improvement of high-speed IC are outlined.

**22432 Three-laser intercavity interferometer for the study of low-density plasmas.** Aiken, J.; Higginson, G.S. (York Univ. (UK). Dept. of Physics). *J. Phys., D (London);* **10**: No. 12, 1541-1547(21 Aug 1977).

A novel method for frequency controlling two or more lasers to a high degree of stability, suitable for a low-frequency heterodyning experiment in normal laboratory conditions is described. The method made use of a principal 'local oscillator laser', frequency controlled to 'line-centre', to which two further lasers were controlled without modulation by a method developed by Wilson and Rowley (J. Sci. Instrum.; 43:314 (1966)). The plasma device was placed inside the cavity of one of the unmodulated stabilized lasers, and changes of heterodyne frequency with the second stabilized laser were measured at two wavelengths (in this case 0.633 and 3.39 μm lines of the helium-neon laser) to permit resolution of the dispersive electronic component and non-dispersive molecular component of the plasma. Electron densities in the range $10^{12}$ to $10^{15}$ $cm^{-3}$ have been measured in pulsed hydrogen arcs in diode and triode devices at pressures circa 500 m Torr, with a small experimental uncertainty and a temporal resolution of the order of 1 μs. Molecular depletion has been shown to be an important phenomenon at the cathode and grid regions of such devices, detection of pressure changes of the order of 1% being possible, although with a large uncertainty.

**22433 10.6 μm interferometry and Faraday rotation measurements on a theta-pinch plasma.** Brown, R.; Deuchars, W.M.; Illingworth, R.; Irving, J. (Strathclyde Univ., Glasgow (UK)). *J. Phys., D (London);* **10**: No. 12, 1575-1581(21 Aug 1977).

The initial stages of a 40 kJ theta pinch in hydrogen at 13 mTorr have been investigated using a 10.6 μm TEA $CO_2$ laser. Electron density profiles measured across the tube using a single-fringe interferometry show two imploding density fronts with a region of increased ionization at the tube axis when the first front approaches the axis. Electrons are swept up mainly by the outer front. 10.6 μm Faraday rotation measurements of the magnetic field on the axis during the implosion stages are described. During the initial stages, the magnetic field is reversed with magnitude increasing to 0.4 +- 0.01 Wb $m^{-2}$ but changes direction at t = 410 ns when the first density front approaches the axis.

**22434 Studies of pellet evaporation by $CO_2$ laser, using multiple-frame argon-ion laser shadow photography.** Donaldson, T.P.; Kachen, G.I.; Spalding, I.J. (UKAEA Research Group, Abingdon. Culham Lab.). *J. Phys., D (London);* **10**: No. 12, 1589-1597(21 Aug 1977).

Framing shadowgraphs have been used to investigate the interaction of a 1.5 GW $CO_2$ laser with polythene pellets in vacuo. A Spectra-Physics argon-ion laser was used as source and a Hadland Imacon camera for recording, at framing rates of $10^6$ to $10^7$ Hz. Part of the pellet ionized, and the remainder fragmented. Theoretical analysis suggests that fragmentation can be avoided if the laser pulse and pellet geometry are mutually optimized; optimal parameters are estimated.

**22435 Flow velocity measurement in high-current arcs using Doppler-shifted plasma scattering.** Irie, M.; Barrault, M.R. (Liverpool Univ. (UK)). *J. Phys., D (London);* **10**: No. 12, 1599-1605(21 Aug 1977).

In high-current arc discharges the plasma flow velocity distribution is believed to have a very strong spatial dependence (Barrault et al (J. Phys. E: Sci. Instrum.; 7:663 (1974)) and the well established technique of laser velocimetry is apt to behave incorrectly. In this paper, the extension of the laser scattering technique, which has been mainly used in controlled thermonuclear fusion research (Evans and Katzenstein (Rep. Prog. Phys.; 32:207 (1969)) is described. The method offers a new velocimetry technique which can offer pinpoint ($1\ mm^3$ order) well-time-resolved ($10^1$ ns) diagnostics of the plasma flow velocity.

**22436 Determination of plasma density and temperature profiles using magneto-acoustic oscillations.** Brennan, M.H.; Jessup, B.L.; Jones, I.R. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). *J. Plasma Phys.;* **18**: 127-138(Aug 1977).

Theoretical and experimental refinements in the use of forced radial magneto-acoustic oscillations of a magnetized plasma as a diagnostic technique are reported. The theory of such oscillations is extended to include radial variations in electron number density, neutral atom density and plasma temperature. In experiments carried out in an argon afterglow plasma, observations of the radial variation of the oscillation amplitude, and of the total flux in the plasma, are combined with theory to yield radial density and temperature profiles. These profiles are in good agreement with independent measurements made using laser interferometry and spectroscopic techniques.

**22437 Advanced fuel fusion experimentation with migmacells II and III orbit diagnostics and lifetime measurements.** Menasian, S.C.; Ferrer, J.; Maglich, B.C.; Mazarakis, M.G.; Nering, J.E.; Powell, C.; Sandberg, J.; Whittemore, A.R. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **144**: No. 1, 49-50(1 Jul 1977).

Using both destructive and nondestructive diagnostic techniques, the number of stored ions, the distribution of ions among single particle orbits, the confinement times for stored particles and the fraction of molecular $D_2^+$ ions dissociated during the first passage through the migmacell are determined. Results from Migmacell II experiments show lifetimes of 10 ms for $10^9$ stored deuterons at a background pressure of $4x10^{-7}$ torr air. Migmacell III experiments to date have demonstrated confinement times of 2 s in an unbaked ultra-high vacuum system. The number of stored particles observed to date is in excess of $10^{10}$. Migmacell III particle distributions are strongly peaked at the center of the cell, indicating a significant amount of beam-migma dissociation.

**22438 Determination of electron velocity distribution from the microwave emission of a low-temperature plasma.** Pavlova, L.S.; Polyakov, V.M. (Institute of Radio Engineering and Electronics, Academy of Sciences of the USSR, Moscow). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 664-666(Jun 1977).

The parameters of the electron velocity distribution can be determined from the microwave emission of a low-temperature plasma. Microwave emission spectra are studied as functions of the distribution function. Approximate equations are found for determining the parameters of the distribution function for limiting values of the electron collision rate. The use of this method to study an argon discharge is discussed.

**22439 Investigation of perturbation of a laser plasma density profile by the high-speed interferometry method.** Zakharenkov, Yu.A.; Krokhin, O.N.; Sklizkov, G.V.; Shikanov, A.S. (AN SSSR, Moscow. Fizicheskij Inst.). *Kvantovaya Elektron. (Moscow);* **3**: No. 5, 1068-1079(May 1976). (In Russian).

Principal parameters are considered of the optical system for recording of laser plasma interferograms, as well as methods of their numerical processing with the aid of a computer. A scheme is described of the experimental system for high-speed interferometry under slit scanning on the photoelectric recorder with the temporal resolution of $10^{-10}$ s. For processing of the obtained laser plasma interferograms special additional calculation methods have been used which improve the accuracy of the results. The use of the developed technique makes it possible to detect a development of a perturbation on the profile of the electron density of the plasma corona with radiation fluxes of approximately $5x10^{14}$ $W/cm^2$.

**22440 Spatial resolution of laser produced plasmas with x-ray crystals.** Yaakobi, B.; Bristow, T.C.; Hauer, A. (Univ of Rochester, NY). *Opt. Commun.;* **14**: No. 3, 336-338(Jul 1975).

X-ray spectra taken with good quality flat crystals can yield spatial resolution of small plasma sources at the expense of spectral resolution. 40 μm spatial resolution of a laser-produced aluminum plasma was obtained using lines of wavelength approximately 6 A.

**22441 Scheme for $CO_2$ laser scattering to measure the ion temperature in a tokamak plasma.** Gondhalekar, A.; Keilmann, F. (Max Planck Inst fuer Plasmaphys, Garching, Ger). *Opt. Commun.;* **14**: No. 2, 263-266(Jun 1975).

A simple optical scheme is proposed for scattering of pulsed high-power $CO_2$ laser radiation from a plasma, and to achieve heterodyne detection to receive the very low scattered radiation intensity and resolve the narrow spectrum. Ion temperature measurement with microsecond time resolution in fusion oriented tokamak plasmas seems feasible. 7 refs.

**22442 (IS-Trans—99) Mass spectroscopic determination of plasma parameters in laser microplasmas of solids and their mathematical relationships.** Zahn, H.; Dietze, H.J. Translated from *Exp. Tech. Phys.;* **20**: No. 5, 401-408(1972). 14p. Dep. NTIS, PC A02/MF A01.

This paper shows the possibility of determining mass spectroscopically the parameters of a microplasma produced by laser-induced emission of atoms, ions and electrons from solids. Two relations were found empirically. A third relation, which represents the probable connection between the vaporized particles and the power of the laser beam, is given. This relation must be proved by further investigations.

## PLASMA KINETICS - GENERAL

**22443 Early stages of light interaction with solids at extreme intensities.** Steverding, B.; Gibson, F.P. (Army Missile Command,

Redstone Arsenal, Ala. (USA)). *J. Phys., D (London);* **10**: No. 12, 1683-1691(21 Aug 1977).

Electron and radiation transport of energy is treated by self-similar methods in aluminium targets exposed to extreme radiation intensities. Detailed numerical solutions of this phenomenon are given including the effects of incomplete ionization on the conduction processes and the internal energy.

**22444 Thermal equilibrium in plasmas containing negative ions. II.** Hey, J.D. (Cape Town Univ. (South Africa). Dept. of Physics). *J. Quant. Spectrosc. Radiat. Transfer;* **18**: No. 2, 253-254(Aug 1977).

The additional existence of positive molecular ions, such as $H_3^+$, in a low-temperature plasma containing appreciable numbers of negative ions, is considered. This is shown to have no effect on conclusions reached earlier with regard to the effect of negative ion formation on the achievement of LTE level populations by the neutral atoms.

**22445 Methods of 'tailoring' ion distributions in phase space ('morphodynamics').** Channon, S.R. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **144**: No. 1, 57-62(1 Jul 1977).

The objective of migma ion morphonomy studies is to find out what can be done toward shaping the ion distribution. Primarily, the fusion rate should be maximized relative to losses, but also 'handles' are required in the event that instabilities should manifest themselves. The two methods for affecting the ion distribution which are discussed are, first, the use of oscillating electrons and, second, shaping of the externally applied magnetic field. The objective in this discussion is to illustrate how these can affect the ion distribution by presenting some numerical results.

**22446 Tailoring electron velocity distributions in phase space (morphodynamics).** Golden, J.E. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **144**: No. 1, 63-64(1 Jul 1977).

Some of the mechanisms which can affect the velocity space distribution function for electrons in a migma are discussed. For the most part, the work discussed has been initiated much more recently than the work on ion distributions and for that reason the results are much more qualitative. Distribution shaping in the context used here refers to the occurrence in the migma of non-Maxwellian energy distributions and non-isotropic velocity distributions for the electrons. The presence of electrons is required in the system, as in any device of this type, as a neutralizing agent. Without the presence of electrons, ion densities of only $10^{10}$-$10^{11}$ $cm^{-3}$ are possible, but these densities are several orders of magnitude too low for useful power output. Neutralization is thus required and it is suspected that this will occur naturally as a consequence of the existence of a positive ambipolar potential. While the electrons are necessary for the above reason, their presence in the migma does present some problems; the primary one being that they may give off excessive amounts of bremsstrahlung and synchrotron radiation. In calculating the rate of energy loss by radiative processes from the migma, one needs to know the manner in which the energy of the electrons is distributed.

**22447** (LA-tr—77-69) **Experimental investigation of the operating characteristic of a plasma focus.** Rapp, H. (Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Plasmaforschung). 1977. Translation of IPF—74-1. 117p. Dep. NTIS, PC A06/MF A01.

The design of a 60 kJ plasma focus installation of the Mather type for generating a deuterium plasma with fusion conditions is described. The advantages of a plasma focus layout in comparison with the linear z-pinch are explained, and questions which arise from the interaction of energy storage and plasma accelerator are discussed. The conclusions are used as a basis for planning the entire installation and dimensioning the individual components. This is followed by a description of some typical difficulties which can have a negative effect on the operation of the plasma focus and how these problems were overcome. Photographic observation of the acceleration and compression process has provided important information concerning the configuration, structure and velocity of the plasma, which is supplemented by magnetic probe measurements of the variations in current. Additional observations involve measurements of neutron yield, neutron flux anisotropy and the neutron spectrum. A theoretical analysis is also presented.

## PLASMA KINETICS - EXPERIMENTAL

**22448** (N—77-26985) **Experimental and theoretical work in plasma physics. Annual status report, 31 December 1975.** (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica). Jun 1976. 92p.

Experimental topics discussed are the high-beta experiment SPICA, turbulent plasma heating, and gas blanket research. Theoretical topics concern Tokamak and screw-pinch configurations, as well as transport theory.

**22449** (PPPL—1403) **Ion energy balance in ohmically heated PLT discharges.** Brusati, M.; Davis, S.L.; Hosea, J.C.; Strachan, J.D.; Suckewer, S. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Nov 1977. Contract EY-76-C-02-3073. 41p. Dep. NTIS, PC A03/MF A01.

Radial profiles of the ion temperature have been measured on PLT using charge exchange, neutron emission, and Doppler broadening of oxygen and carbon impurity line radiation. The ion temperature (less than or equal to 1.2 keV) is consistent with Hinton-Rosenbluth neoclassical heat conduction in the plateau regime as the dominant energy loss from the plasma with central ion energy confinement times less than or equal to 0.1 sec.

**22450 Magnetic extraction of runaway electrons from a tokamak plasma.** Stone, D.S.; Richards, B. (Department of Physics and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Phys. Fluids;* **21**: No. 1, 149-150(Jan 1978).

A short (~0.5 msec) localized vertical magnetic field (~200 G) is used to extract runaway electrons from a tokamak plasma without affecting the thermal component of the plasma. This effect is documented with measurements of the hard x-ray and suprathermal microwave emission from the torus.

**22451** (UCRL-Trans—11307) **Method of studying the spectral composition of powerful high-energy deuteron beams formed in a plasma focus.** Filippov, N.V.; Filippova, T.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Nov 1977. Translation of IAE—2827. 15p. Dep. NTIS, PC A02/MF A01.

This work describes a method for quantitative determination of the spectral composition of a powerful deuteron beam formed by accumulation of a plasma envelope in systems such as a noncylindrical Z-pinch. The beam moves in the normal direction, i.e., from the anode into the space beyond the cathode. The method is based on the principle of the drift spectrometer with oscillography and corresponding processing of signals from a scintillation detector generated by neutrons arising in the $^{12}C(d,n)^{13}N$ reaction in a carbon target when it is struck by the deuteron beam.

**22452 Investigation of particle velocities in a 'critical velocity' rotating plasma.** Himmel, G.; Moebius, E.; Piel, A. (Bochum Univ. (Germany, F.R.). Inst. fuer Experimentalphysik 2). *Z. Naturforsch., a;* **32**: No. 6, 577-579(Jun 1977).

The velocities of helium ions and neutrals are derived from Doppler shifted spectral lines He II 4686 A and He I 5876 A respectively. The ion velocity proves to be in accordance with the speed of rotating spokes which are usually observed in the build-up phase of rotating plasmas. It is demonstrated that the spoke velocity represents the plasma mass motion. Braking of plasma motion and acceleration of the neutrals to a value near Alven's critical velocity occurs within 10 μs.

**22453 Superthermal X radiation in the TM-3 tokamak.** Alikaev, V.V.; Bobrovskii, G.A.; Razumova, K.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). *Fiz. Plazmy;* **1**: No. 4, 556-562(Jul 1975). (In Russian).

Accelerated electrons producing in a toroidal electric field of a tokomak cause an epithermal X radiation from a plasma volume. It contains characteristic radiation of impurity ions alongside a continuum. The aim of the paper is to estimate a quantity of impurities, and also a number of accelerated electrons and the fraction of a toroidal current carried over by them on the base of the intensity of characteristic lines. It has been possible to obtain absolute estimates owing to a dosed addition of krypton into hydrogen served as an operating gas. Under the assumption that krypton is accumulated in plasma due to 'ion evacuation', the maximum fraction of current transferred by escaping electrons in the regime under investigation Jsub(sec) approximately 1 kA at the total current J approximately 15 kA; linear density of accelerated electrons approximately $10^{13}$ $cm^{-1}$ at Nsub(e)sup(0) = $2x10^{14}$ $cm^{-1}$. Main impurities are tungsten (Nsub(w) approximately $1.5x10^{12}$ $cm^{-1}$) and elements of the iron group (Nsub(Fe) approximately $8x10^{12}$ $cm^{-1}$). This maximum estimation of impurities allows one to fit the measured electric conductivity of plasma to the calculated one.

## PLASMA KINETICS - THEORETICAL

*REFER ALSO TO CITATION(S) 22510*

**22454** (INIS-mf—3355) **Screw pinch approach to controlled fusion.** Hoekzema, J.A. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica). 6 Dec 1976. 51p. (In Dutch and English). NTIS (US Sales Only), MF A01.

Thesis.

This thesis is a collection of publications on the toroidal screw pinch. In a screw-pinch experiment the plasma is pinched and confined by a helical magnetic field, whose toroidal and poloidal components are applied simultaneously. A method is described to

measure the electron density profile on a line through the plasma, using two small diagnostic ports. It is shown that the axial contraction is much reduced if force-free currents are induced in the outside region. In circular geometry the plasma becomes n-shaped for high $\beta$-values. It is pointed out that if the dilute plasma in the outside region has a finite resistivity, the currents in the region near the wall first disappear. The stability regions above the Kruskal-Shafranov limit then shrink in size. A pinch is mainly heated by the irreversible implosion. A simple model to calculate the heating of a pinch if a bias field is initially present in the plasma, is presented.

**22455** (ORNL/TM—6103) **Dynamics of high energy runaway electrons in the Oak Ridge tokamak.** Zweben, S.J.; Knoepfel, H. (Oak Ridge National Lab., Tenn. (USA)). Dec 1977. Contract W-7405-ENG-26. 39p. Dep. NTIS, PC A03/MF A01.

Runaway electrons produced during normal discharges in the Oak Ridge Tokamak (ORMAK) have been studied with a hard x-ray diagnostic system along with most of the other diagnostics available on this machine. It is found that runaways can attain maximum energies of up to 10 MeV and be contained over times of typically 50 msec. A simple physical model is proposed that is consistent with most of the observed high energy runaway phenomena. Some properties of the overall runaway distribtion generated in tokamaks are inferred from these results and are discussed in terms of runaway generation, acceleration, and transport.

**22456** (PPPL—1401) **Random phase wave: a soluble non-Markovian system.** Dewar, R.L. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Dec 1977. Contract EY-76-C-02-3073. 33p. Dep. NTIS, PC A03/MF A01.

The averaged propagator and the corresponding mass operator (non-Markovian particle-wave collision operator) of a particle being accelerated by a random potential are constructed explicitly in a model system. The model consists of an ensemble of monochromatic waves of random phase, such as arises in narrow-bandwidth plasma turbulence, and is particularly interesting as a system exhibiting strong trapping. An essential simplifying feature is that the propagator is evaluated in oscillation-center picture, which greatly simplifies the momentum-space operators occurring in the problem, and leads to a remarkable factorization of the mass operator. General analyticity and symmetry properties are derived using a projection-operator method, and verified for the solution of the model system. The nature of the memory exhibited by the mass operator is briefly examined.

**22457** (PPPL—1404) **Higher-order multipoles and splines in plasma simulations.** Okuda, H.; Cheng, C.Z. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Dec 1977. Contract EY-76-C-02-3073. 29p. Dep. NTIS, PC A03/MF A01.

Reduction of spatial grid effects in plasma simulations has been studied numerically using higher order multipole expansions and spline method in one dimension. It is found that, while keeping the higher order moments such as quadrupole and octopole moments substantially reduces the grid effects, quadratic and cubic splines in general have better stability properties for numerical plasma simulations when the Debye length is much smaller than the grid size. In particular, spline method may be useful in three dimensional simulations for plasma confinement where the grid size in the axial direction is much greater than the Debye length.

**22458 Enhanced transport across laser generated magnetic fields.** Max, C.E.; Manheimer, W.M.; Thomson, J.J. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *Phys. Fluids;* **21**: No. 1, 128-139(Jan 1978).

Laser generated mega-Gauss magnetic fields may have a disordered small-scale structure, because many different field generation mechanisms are operating simultaneously. Electron cross-field transport in such fields is studied, concentrating on three specific nonclassical transport processes: resonant scattering, field line wandering, and an analog of neoclassical diffusion. Each of these mechanisms seems capable of producing cross-field transport rates significantly faster than the classical values for a mega-Gauss magnetic field, yet considerably slower than the classical value for a field-free plasma.

**22459 Resonant absorption in plasma density profiles produced by laser heating, heat flow, and hydrodynamics.** Malone, R.C.; Morse, R.L. (Theoretical Division, University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Phys. Fluids;* **21**: No. 1, 143-144(Jan 1978).

Efficiency and optimum angle of incidence of combined resonant and collisional absorption of laser light are found by numerical simulation and an economical extension of ray tracing to be moderately insensitive to pulse width and peak power.

**22460 Neoclassical transport of a multi-species plasma in a mixed regime with several collisional species.** Gelbard, E.M.; Hirshman, S.P. (Applied Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Phys. Fluids;* **21**: No. 1, 145-146(Jan 1978).

Neoclassical transport coefficients are derived for a multi-species plasma in a mixed regime, with several banana-plateau species, a, and several Pfirsch—Schlueter species, z. It is assumed that m/sub a/very-much-less-thanm/sub z/, but the masses are otherwise arbitrary.

**22461 Long time behavior of the velocity autocorrelation function in a plasma.** Varley, R.L. (Hunter Coll., New York (USA)). *Phys. Lett., A;* **62**: No. 5, 340-342(5 Sep 1977).

The utilization of the Landau-Placzek method results in a velocity autocorrelation function for a one component plasma having oscillatory behavior (at the plasma frequency) in addition to the tsup(-(d/2)) (d=dimension) behavior previously found in neutral gas systems.

**22462 Analytical solution for the distribution of neutral particles in a Maxwellian plasma using the method of singular eigenfunctions.** Connor, J.W. (UKAEA Research Group, Abingdon. Culham Lab.). *Plasma Phys.;* **19**: No. 9, 853-873(Sep 1977).

The method of singular eigenfunctions is used to obtain a solution to the problem of penetration of neutrals into a dense plasma with a realistic Maxwellian ion distribution. A general solution is obtained and explicit results given for models of the reflection processes at the wall. These include the neutral density distribution, the emergent neutral velocity distribution and the neutral particle and energy fluxes to the wall. The analytic results indicate the validity of the diffusion approximation and provide a boundary condition for such a treatment.

**22463 Generation of electric and diffusion currents (magnetic fields) in arbitrarily moving media by electromagnetic radiation.** Schmutzer, E.; Wilhelmi, B. (Friedrich-Schiller-Universitaet, Jena (German Democratic Republic). Sektion Physik). *Plasma Phys.;* **19**: No. 9, 799-809(Sep 1977).

An arbitrarily moving medium, e.g. plasma, under the influence of an electromagnetic and gravitational field is considered. After solving the equation of motion for the charged particles by using a special approximation technique the expressions for the electric current density and the diffusion current density are calculated. Of particular interest is the generation of an electric current, i.e. also a magnetic field, by the Poynting vector. The corresponding material coefficients show a characteristic frequency dependence. Numerical estimates exhibit an interesting order of magnitude of the expected effects.

**22464 Electrostatic potential in a low-density plasma in toroidal systems.** Laing, E.W.; Tan, W.P.S. (Glasgow Univ. (UK). Dept. of Natural Philosophy). *J. Phys., D (London);* **10**: No. 12, 1619-1634(21 Aug 1977).

The guiding centre motion of a charge particle in an axisymmetric magnetic field configuration is completely determined by the invariants of motion which represent conservation of energy, canonical angular momentum about the axis of symmetry, and the magnetic moment associated with rotation about magnetic field lines. Using these invariants of motion, it is possible to construct Vlasov equilibrium distributions of ions and electrons and to calculate a self-consistent electrostatic potential in the plasma. Results obtained for the Levitron magnetic containment device at Culham Laboratory are presented.

**22465 Quantum field theoretical approach to plasmas.** Gomberoff, L. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). *J. Plasma Phys.;* **18**: 145-154(Aug 1977).

The Feynman-Schwinger formalism of quantum electrodynamics is used in deriving the classical dispersion relation for electrostatic and electromagnetic waves in a homogeneous plasma. It is then argued that such techniques can be helpful in dealing with quasi-linear and nonlinear problems in plasmas.

**22466 Multiple spatial scaling and the weak coupling approximation. II. Homogeneous kinetic equation.** Kleinsmith, P.E. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). *J. Plasma Phys.;* **18**: 99-111(Aug 1977).

A modified form of the Bogoliubov plasma cluster expansion is applied to the derivation of a divergence-free kinetic equation from the BBGKY hierarchy. Special attention is given to the conditions under which the Landau kinetic equation may be derived from this more general formulation.

**22467 Test charge problem in the theory of bounded plasmas.** Tegeback, R.; Usenko, A.S.; Yakimenko, I.P.; Zagorodny, A.G. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). *J. Plasma Phys.;* **18**: 113-125(Aug 1977).

The test charge problem for a semi-infinite plasma is formulated. Expressions for the far field potential are derived for stationary and slowly moving test charges. By applying the superposition principle for uncorrelated dressed test particles the dynamic form factor as well as the energy spectrum of the spontaneous radiation field are calculated.

**22468 Neutralization of the charge of an electron beam in a plasma.** Anosova, L.M.; Gorbunov, L.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 6, 660-663(Jun 1977).

The equilibrium of a relativistic electron beam in a plasma is analyzed in the hydrodynamic approximation taking account of the charge-separation field. It is shown that charge neutralization holds overall. The equilibrium beam current is a weak function of the plasma properties.

**22469 Hydrogen transport in a two-dimensional torodial plasma.** Wienke, B.R.; Miller, W.F. Jr.; Seed, T.J. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 88-89(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22470 Burn stability in a reversed field pinch.** Stimpson, H.R.; Miley, G.H. (Univ. of Illinois, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 92-93(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22471 Neoclassical diffusion in toroidal three-cut magnetic field.** Nemov, V.V.; Shishkin, A.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). *Fiz. Plazmy;* **1**: No. 4, 563-568(Jul 1975). (In Russian).

Quasi-classical diffusion is investigated in the regime of toroidal drift of 'bananas' in a three cut magnetic field. Unlike previous papers, it is supposed that the inhomogeneity of a helical magnetic field epsilonsub(k) is of the same order or less than that of the toroidal inhomogeneity epsilonsub(t). The case is considered when the efficient frequency of particle collisions exceeds that of the 'banana' precession around the magnetic axis. Expressions for diffusion flows and coefficients are obtained that transform into available ones at epsilonsub(h) > > epsilonsub(t).

## PLASMA PRODUCTION

**22472 Evidence of resonance absorption in laser-produced plasmas from the polarization and angular dependence of high-energy x-ray bremsstrahlung emission.** Luther-Davies, B. (Laser Physics Group, Department of Engineering Physics, Research School of Physical Sciences, The Australian National University, Canberra 2601 Australia). *Appl. Phys. Lett.;* **32**: No. 4, 209-211(15 Feb 1978).

Measurements are reported of the polarization and angular dependence of the amplitude and "temperature" of high-energy bremsstrahlung emission from planar copper targets irradiated with 25-psec neodymium laser pulses at 5 +- 2 x $10^{14}$ W/cm$^2$. A resonance in the emission is observed for p-polarized incident radiation at an angle of incidence of 25°. The results indicate the presence of plasma density scale lengths of about 1 μm and 17% absorption due to the resonance absorption mechanism.

**22473 Optical measurements of laser-detonated shock waves in thin lithium wires.** Samson, J.C. (National Research Council of Canada, Division of Physics, Ottawa, K1A OR6, Canada). *J. Appl. Phys.;* **49**: No. 1, 121-126(Jan 1978).

Shock-heated plasmas were produced by focusing 1-ns 1.06-μm laser pulses to intensities of 2 x $10^{12}$ W/cm$^2$ on 100-μm-diam lithium wires. Interferograms and shadowgrams produced with 1-ns 0.53-μm pulses indicate two distinct phases in the plasma expansion. The first phase is a spherical core of dense plasma produced by a shock propagating through the wire, normal to the axis of the wire, and along the laser beam. Interferometric measurements of the expansion and drift velocity of this phase indicate that the initial pressure behind the shock was 1.4—1.9 Mbar, the compression was 2.6—4.2, the shock velocity was (2.1—2.2) x $10^6$ cm/s, and the fluid velocity was (1.3—1.6) x $10^6$ cm/s. The second phase is an approximately cylindrical column of partially ionized material produced by shocks propagating along the wire. Shadowgrams show that the velocities of these shocks were greater than 1.7 x $10^6$ cm/s.

**22474 Shock waves and ionizing radiation in plasmas produced by a mode-locked laser.** Meyer, I.; Stritzke, P. (Hamburg Univ. (Germany, F.R.). Inst. fuer Angewandte Physik). *J. Phys., D (London);* **10**: No. 12, 1635-1641(21 Aug 1977).

The expansion of plasmas produced by a mode-locked Nd : glass laser has been studied. With help of the second harmonic radiation of the laser itself the shock waves in the initial stages after breakdown are recorded. With a streak camera the time development of the plasma depending on the gas pressure and the focal length of the focusing lens was studied in He, Ar, Kr, Xe, $N_2$, $CO_2$ and $SF_6$. While the shock waves obey the well known relations for ideal shock waves, the stepwise plasma expansion towards the lens can be described by a simple ionization model.

**22475 Expansion of a laser-produced aluminium plasma and the heat penetration in multi-layered targets.** Zigler, A.; Zmora, H.; Paiss, Y. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center); Schwob, J.L. *J. Phys., D (London);* **10**: No. 12, L159-L162(21 Aug 1977).

H-like and He-like Al lines and their satellites are obtained from Al and polyethylene layered targets irradiated by a Nd : glass laser at a power flux of 2 x $10^{13}$ W cm$^{-2}$ on target. Two-dimensional spatial resolution is achieved using a flat crystal spectrograph incorporating a wire shadow technique. Expansion profiles in the lateral direction as a function of the Al layer location are measured and interpreted in terms of the temporal history of the interaction. By varying the location of the Al layer, the penetration depth of the heat wave front is also determined. It is found that in this power flux range, heat conduction can be explained by classical mechanisms.

## PLASMA INSTABILITIES

*REFER ALSO TO CITATION(S) 22423*

**22476 (ORNL/TM—5967) Macroscopic stability and β limits in the ELMO Bumpy Torus.** Nelson, D.B.; Hedrick, C.L. (Oak Ridge National Lab., Tenn. (USA)). Dec 1977. Contract W-7405-ENG-26. 35p. Dep. NTIS, PC A03/MF A01.

Magnetohydrodynamic stability limits are determined for the ELMO Bumpy Torus. The relativistic hot electron annuli are considered to be rigid, modifying the magnetic field but not interacting with the instability. A modified energy principle is used, and the stability problem is reduced to determination of the eigenvalues of an ordinary differential equation along each field line. A threshold hot electron current is required for stability; its value agrees with experimental measurements. The calculations show that stable high β equilibria are easily created.

**22477 (PPPL—1397) Theory and numerical simulations on collisionless drift instabilities in three dimensions.** Cheng, C.Z.; Okuda, H. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Nov 1977. Contract EY-76-C-02-3073. 69p. Dep. NTIS, PC A04/MF A01.

Nonlinear behavior of the collisionless drift instabilities and the resultant anomalous plasma diffusion have been studied by means of computer simulations and analytic theory. The simulation model used is a full three dimensional electrostatic model in a cylindrical geometry in an external magnetic field. Full dynamics is employed for the ion motion while the guiding center approximations are used for the motion of electrons which allows us to use rather realistic plasma parameters in the simulations. The results of simulations indicate that a strong turbulence develops through the nonlinear interaction of the drift instabilities which results in the formation of convective cells and anomalous particle diffusion. The broad frequency spectrum resembles to those observed recently in toroidal confinement devices. Analytic theory is developed based on the mode-coupling process to explain the generation of convective cells and strong plasma turbulence along with the estimate of the resultant particle diffusion.

**22478 (PPPL—1400) Stabilization of the axisymmetric instability in the PDX tokamak.** Jardin, S.C. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Dec 1977. Contract EY-76-C-02-3073. 24p. Dep. NTIS, PC A02/MF A01.

Passive stabilization, associated with the mutual inductances of the field shaping coils with the plasma and with each other, can stabilize the axisymmetric magnetohydrodynamic instability in the Princeton Poloidal Divertor Experiment device that was observed in earlier numerical studies.

**22479 Model of the Rayleigh-Taylor stability of an ablating fluid.** Catto, P.J. (Department of Mechanical and Aeropsace Sciences and Laboratory for Laser Energetics, College of Engineering and Applied Sciences, University of Rochester, Rochester, New York 14627). *Phys. Fluids;* **21**: No. 1, 30-33(Jan 1978).

An incompressible and inviscid model for the Rayleigh—Taylor stability of an ablating fluid in the absence of convection is presented and solved analytically for boundary conditions appropriate to laser produced plasmas. The wavenumbers k perpendicular to the density gradient of scale length L are found to be relatively insensitive to ablative stabilization for the most unstable radial eigenmodes, $k^2L^2 > \text{or} \approx 1$.

**22480 Influence of finite ion Larmor radius effects on the ion resonance instability in a nonneutral plasma column.** Davidson, R.C.; Uhm, H. (Division of Magnetic Fusion Energy, Energy Research and Development Administration, Washington, D. C. 20545). *Phys. Fluids;* **21**: No. 1, 60-71(Jan 1978).

The influence of finite ion Larmor radius effects on the ion resonance instability in a nonneutral plasma column aligned parallel to a uniform axial magnetic field Boe/sub z/ is investigated. The analysis is carried out within the framework of a hybrid Vlasov-fluid model in which the ions are described by the Vlasov equation and

the electrons are described as a macroscopic, cold fluid. Electrostatic stability properties are calculated for the case in which the equilibrium electron and ion density profiles are rectangular and the ion distribution function is specified by f°/sub i/=const x δ (H/sub perpendiculari-italic/P/sub theta -Ti-italic/) G (v/sub z/). The resulting eigenvalue equation for the perturbed electrostatic potential phi-circumflex/sub l/(r) is solved exactly to give a closed algebraic dispersion relation for the complex eigenfrequency ω. This dispersion relation is solved numerically, and it is shown that the growth rate of the ion resonance instability exhibits a sensitive dependence on plasma parameters. For example, finite ion Larmor radius effects can have a strong stabilizing influence for azimuthal mode numbers l> or =2, particularly when the equilibrium self-electric field is sufficiently weak. For the fundamental mode (l=1), however, stability properties are identical to those calculated from a macroscopic two-fluid model, and the growth rate is unaffected by the value of the ion Larmor radius.

**22481 Second-order theory for kparallelB$_0$ electromagnetic instabilities.** Gary, S.P.; Feldman, W.C. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Phys. Fluids;* **21**: No. 1, 72-80(Jan 1978).

Electromagnetic instabilities which propagate parallel to an external magnetic field in an infinite, homogeneous Vlasov plasma are considered. Linear theory is used to construct second-order expressions for the time rates of change of momentum, as well as perpendicular, parallel, and total energies of each plasma species. The results are expressed in a concise form appropriate for many instabilities of this type. The ion cyclotron (T/sub perpendiculari/ >T/sub paralleli/) and firehose (T/sub paralleli/>T/sub perpendiculari/) instabilities are considered as examples.

**22482 Nonlinear instability of electromagnetic drift waves.** Mima, K.; Hasegawa, A. (Bell Laboratories, Murray Hill, New Jersey 07974). *Phys. Fluids;* **21**: No. 1, 81-86(Jan 1978).

A pair of electromagnetic drift waves is shown to be excited simultaneously by an induced Cerenkov emission by electrons. The instability is shown to be explosive. However, its property is different from the ordinary explosive instability involving three wave interactions with a negative energy wave pump. The instability here is excited by the inverted population of electrons (inverse Landau damping) and is less sensitive to the frequency mismatch or dissipation. The nonlinear growth rate is shown to exceed the linear growth rate at a reasonably small level of wave amplitude. A magnetic field perturbation is essential for this process.

**22483 Experiments on current-driven three-dimensional ion sound turbulence. Part I: Return-current limited electron beam injection.** Stenzel, R.L. (TRW Systems, Redondo Beach, California 90278). *Phys. Fluids;* **21**: No. 1, 93-98(Jan 1978).

The injection of an electron beam into a weakly collisional magnetized background plasma is investigated experimentally. The beam-plasma system is so large that boundary effects are unimportant for establishing the current flow. It is shown that the injected beam current is balanced by a field-aligned return current provided by background electrons drifting toward the beam source. The conditions for an ion sound instability driven by the return current are met. The maximum injected beam current is found to be limited to the background electron saturation current to the beam source.

**22484 Experiments on current-driven three-dimensional ion sound turbulence. Part II: Wave dynamics.** Stenzel, R.L. (TRW Systems, Redondo Beach, California 90278). *Phys. Fluids;* **21**: No. 1, 99-108(Jan 1978).

A fast electron beam is injected into an essentially collisionless magnetoplasma. The beam current closes via a field-aligned return current which drives an ion acoustic instability. The observed frequency spectrum is close to that predicted by renormalized turbulence theory. Three-dimensional cross-correlation measurements exhibit a wave vector spectrum extending in magnitude to kλ/sub D/ > or ≈1 and covering in direction a half-space centered around the electron drift. Propagation of phase coherent test waves confirm the three-dimensional character of the instability but also indicate the presence of ion drifts. These can arise from ion trapping in observed large amplitude off-resonant beat modes generated by two obliquely propagating unstable ion acoustic waves.

**22485 Computer simulation of current penetration in a plasma.** Lin, A.T.; Dawson, J.M. (Center for Plasma Physics and Fusion Engineering, University of California, Los Angeles, California 90024). *Phys. Fluids;* **21**: No. 1, 109-116(Jan 1978).

Anomalous current penetration into a plasma is a fundamental process which is important in a number of plasma situations included in which are the formation of discharges and current sheath layers. A recently developed two and one-half dimensional magnetostatic code has been applied to the simulation of this process. Many anomalous processes are involved here including anomalous resistance, anomalous heat conduction, anomalous electron viscosity, and the formation of complex magnetic structures. Of dominant importance is the anomalous resistivity. It is important to identify the instabilities and turbulent processes involved. The results show that the induced current excites lower hybrid turbulence which may be related to lower hybrid oscillations recently observed in microtor. Anomalous heating and heat transport are also observed. In some cases the magnetic field lines are observed to reconnect and form magnetic islands.

**22486 Nonlinear development of lower hybrid cones.** Pereira, N.R.; Sen, A.; Bers, A. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Phys. Fluids;* **21**: No. 1, 117-120(Jan 1978).

The instability of a planar lower hybrid soliton to transverse long wavelength perturbations is investigated numerically. Initially, a kink-like deformation grows in agreement with linear analysis. In the nonlinear regime the soliton breaks up into bunches which move apart and spread the energy throughout the plasma.

**22487 Nonlinear stabilization of the lower-hybrid-drift instability by electron resonance broadening.** Huba, J.D.; Papadopoulos, K. (Naval Research Laboratory, Washington, D. C. 20375). *Phys. Fluids;* **21**: No. 1, 121-123(Jan 1978).

The lower-hybrid-drift instability is shown to be effectively stabilized by electron resonance broadening, especially in finite $\beta$ plasmas. This saturation mechanism allows steady state turbulence to develop which is crucial to plasma phenomena such as magnetic field line reconnection and collisionless shock waves.

**22488 (ORNL-tr—4410) Energy principle and the kink instability in a toroidal plasma with a strong magnetic field.** Pogutse, O.P.; Yurchenko, E.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Dec 1977. Translation by L. Kobylenski of USSR report. 31p. Dep. NTIS, PC A03/MF A01.

First, an equation is obtained for an energy principle in which the kinetic and potential energies are functionals of only one function. It is possible to do this by expanding the exact equation in inverse powers of the strong toroidal magnetic field. This simplified energy principle is accurate within terms of the order of the square of the curvature. Next, the equation is applied to studies of the kink instability in a toroidal plasma. It is shown that branch splitting and the appearance of forbidden zones in the spectrum of unstable Alfven oscillations arise from toroidal curvature. The appearance of these zones clearly shows how plasma stability deteriorates as plasma pressure increases. This effect is proportional to the curvature and plasma pressure and may explain confinement pressure limits discovered by recent computations of the stability of a high $\beta$ tokamak.

**22489 K-spectrum analysis of the nonlinear time development of the electron cyclotron instability.** Cabral, J.A.C.; Silva, M.E.F.; Varandas, C.A.F. *Plasma Phys.;* **19**: No. 9, 895-897(Sep 1977).

A numerical method for temporal analysis of the nonlinear development of burst-like instabilities, based on the determination of their time-resolved k-spectra is introduced.

**22490 Self-oscillations excited by two stream ion-ion instability.** Fujita, T.; Ohnuma, T.; Adachi, S. (Tohoku Univ., Sendai (Japan)). *Plasma Phys.;* **19**: No. 9, 875-887(Sep 1977).

In an ion beam-plasma system, low frequency self-oscillations are observed when an ion beam with velocity near the ion acoustic velocity is injected into the plasma. This oscillation has a discrete spectral structure which results from the fact that the system is axially bounded. A real wave number for each discrete excited mode is determined by the bounded length. The self-oscillation frequency is approximately proportional to the wave number and to the ion beam velocity. These properties of the oscillation are quantitatively explained by the kinetic dispersion relation for the two stream ion-ion instability in the ion beam-plasma system.

**22491 Macroscopic kink instabilities in toroidal relativistic beams.** Spong, D.A.; Eldridge, O.C. (Oak Ridge National Lab., Tenn. (USA)); Kammash, T. *Plasma Phys.;* **19**: No. 9, 817-838(Sep 1977).

Applications of relativistic beams in confinement and heating of toroidal plasmas are considered, and the interaction of such beams with the shear Alfven modes of the background plasma are examined. A class of low-frequency instabilities which are similar to the hydrodynamic kink instabilities of a current-carrying plasma has been found. However, for the case of a beam-plasma configuration, the spectrum of the Alfven mode is, in general, complex, which precludes the use of an energy principle. A normal mode approach is employed, and growth rates and real frequencies for n = 1, m = 1, 2, 3, 4 instabilities for various values of beam energy and vsub(A)/c, are calculated. A cold model for the background plasma is assumed. A fixed boundary model of the beam-plasma is used and effects of energy spread in the beam are discussed.

**22492 Many-wave explosive instability.** Pavlenko, V.P. (AN Ukrainskoj SSR, Kiev); Wilhelmsson, H. (Chalmers Tekniska Hoegs-

kola, Goeteborg (Sweden). Institutionen foer Elektromagnetisk Faeltteori). *Phys. Lett., A;* 62: No. 4, 229-230(22 Aug 1977).

For special initial phase relations and amplitude values intermediate asymptotic state solutions are obtained to the problem of four interacting triplets of waves yielding explosive instability.

**22493 Spatial growth of filamentation instability in a collisionless magnetoplasma.** Tewari, D.P.; Sharma, J.K. (Indian Inst. of Tech., New Delhi. Dept. of Physics); Kaushik, S.C.; Sharma, R.P. *J. Phys., D (London);* 10: No. 12, 1703-1714(21 Aug 1977).

This paper presents an investigation of the effect of the saturating nonlinearity of the pump wave on the spatial growth of the filamentation instability of a Gaussian plane electromagnetic beam in a collisionless magnetoplasma. The nonlinearity is caused by the redistribution of carriers by the ponderomotive force. The growth rate is not a monotonically increasing function of the beam intensity and the optimum size of perturbation increases with the beam intensity beyond a certain value of the beam intensity which is in contrast to the uniform plane beam case. The growth rate decreases with the distance of propagation due to the self-focusing effects and is enhanced with the increase of static magnetic field for extraordinary waves, but the reverse is true for ordinary waves.

**22494 Variational method for electromagnetic waves in a magneto-plasma.** Berk, H.L. (California Univ., Livermore (USA). Lawrence Livermore Lab.); Dominguez, R.R. *J. Plasma Phys.;* 18: 31-48(Aug 1977).

A variational method is presented to derive the electromagnetic response for waves of a model plasma with arbitrary $\beta$ in a magnetic field whose curvature is simulated by a gravitational field. The variational method is particularly well suited for deriving the electromagnetic local dispersion relation and differential equations of long-wavelength modes. In particular, the result is applied to finding the critical $\beta$ needed for stabilization of low-frequency drift waves with density and temperature gradients.

**22495 Modifications in the maximum convective growth rate of the electromagnetic proton cyclotron instability due to the presence of thermal ions.** Gomberoff, L.; Cuperman, S. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy). *J. Plasma Phys.;* 18: 91-97(Aug 1977).

The effect of thermal ions on the convective properties of the electromagnetic proton cyclotron instability is investigated. It is shown that when Asub(p) < 1, where Asub(p) is the proton anisotropy, cold ions, with relative specific charge msub(j)Zsub(j)msub(p) >= 1, stabilize the convective growth of the instability. When Asub(p) > 1, the effect of thermal ions is to enhance the convective growth of the instability in the range where the real part of the frequency, ωsub(r), is smaller than the ion gyro-frequency, Ωsub(j). The maximum enhancement, corresponding to an optimum concentration of heavy ions, is shown to be a constant independent of the species. However, for each species, even for Asub(p) > 1 (except for protons), there is always a range of values for Asub(p) such that the species will stabilize the system. Heavier ions are shown to be more effective in enhancing the convective growth of the instability, in the sense that, the heavier they are, smaller relative concentrations are required to reach the constant value mentioned above. For sufficiently heavy species, the required concentration to optimize the convective growth, is independent of the species.

**22496 Filamentation of large amplitude lower-hybrid waves.** Spatschek, K.H. (Essen Univ. (Gesamthochschule) (Germany, F.R.)); Shukla, P.K.; Yu, M.Y. *J. Plasma Phys.;* 18: 165-172(Aug 1977).

The propagation of a large-amplitude lower-hybrid wave is considered. Modulational instabilities arising from its interaction with low-frequency electrostatic perturbations are investigated. The growth lengths of the convective instabilities are obtained and compared with previous results for adiabatic perturbations.

**22497 Resistive instability of a low-beta plasma cylinder without assumed mode localization.** Wright, R.J. (Imperial Coll. of Science and Technology, London (UK)). *J. Plasma Phys.;* 18: 15-30(Aug 1977).

Resistive instabilities in a low-$\beta$ incompressible cylindrical model are investigated in a weakly sheared magnetic field. No boundary layer assumptions are made. Previous analytic results are found to fail badly when resistivity becomes too large, causing peaking in the growth rate dependence upon resistivity, and when the resonant surface approaches the axis, causing stabilization. The m = 1 tearing mode is investigated and found to lack the cut-off of higher m numbers. Finite Larmor radius effects have expected stabilization properties, but produce a new, delocalized instability.

**22498 Conduction mode variation and inertial conductivity.** Baum, P.J.; Bratenahl, A. (California Univ., Riverside (USA). Dept. of Physics). *Astrophys. Space Sci.;* 49: No. 2, 473-480(Jul 1977).

Using separation of variables in space and time the authors find two-dimensional solutions consistent with simple forms of the inertial Ohm's law, Maxwell's equations, and the equation of momentum transport. Conduction mode variation (a temporal change in electrical conductivity due, e.g., to onset of a plasma instability) is frequently found necessary. The result for the effective conductivity shows that either the conduction mode variation or inertial effects may dominate. In the inertial limit and in the absence of conduction mode variation the results are similar to the limiting results of Speiser. However, the important time constant is the inverse growth rate of the current density rather than the lifetime of a particle in the system. Several solutions have magnetic field structures with neutral points.

**22499 Electromagnetic instabilities in an anisotropic loss-cone plasma.** Vithal, K.L. (Delhi Univ. (India). Dept. of Physics and Astrophysics). *Astrophys. Space Sci.;* 49: No. 2, 293-316(Jul 1977).

A form of general dispersion relation for electromagnetic waves in a fully ionized anisotropic plasma with loss-cone that explicates the contribution of the loss-cone to the dispersion relation is developed. By initially ignoring effects due to anisotropy, it is shown by means of Nyquist diagram technique that an isotropic loss-cone distribution can be unstable to EM waves corresponding to the whistler mode (0<ω<Ωsub(e)). The growth rate is then determined analytically for this distribution, assuming cyclotron resonance between the waves in the whistler mode and particles in the high energy tail of the velocity distribution. By including the effects of anisotropy, a general growth rate is obtained which is found to depend on the anisotropy, the size of the loss-cone, the softness of the energy spectrum, and the fraction of the particles which are resonant with the wave. For particular distributions the relative contributions of the anisotropy and of the loss-cone to the growth rate have been determined. It is seen that loss-cone effects, which depend on the size of the loss-cone as well as the softness of the energy spectrum, can be a significant factor in the determination of the growth rate. For the Lorentzian distribution, the half-width of unstable waves is considerably broadened and the growth rates are somewhat more severe as compared to a two-temperature Maxwellian. The threshold frequency is ωsub(r) approximately = 8Ωsub(e)/9 which confirms the presence of unstable EM waves in the magnetospheric plasma leading to turbulence.

**22500 Stability of a low-temperature plasma.** Alanakyan, Y.R. (All-Union Scientific-Research Institute of Physicotechnical and Radiotechnical Measurements). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* 22: No. 6, 676-678(Jun 1977).

The electron energy distribution is found in a weakly ionized plasma in constant electric field with, spatially periodic perturbations of the plasma properties. If the effective cross section for elastic electron—atom collisions is independent of the electron energy (helium) it is shown that the plasma can be unstable against shortwave perturbations.

**22501 Parametric excitation of low-frequency convective cell modes by a large amplitude lower-hybrid wave in a plasma.** Shukla, P.K.; Yu, M.Y. (Bochum Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). *Can. J. Phys.;* 55: No. 10, 866-867(15 May 1977).

It is shown that convective cell modes can become purely growing modes in the presence of an intense pump wave near the lower-hybrid frequency. The temporal growth rate and threshold of the parametric instability are presented.

**22502 Propagation of nonlinear electrostatic drift solitary waves in a collisionless plasma consisting of two ion species.** Tagare, S.G. (Bochum Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). *Can. J. Phys.;* 55: No. 10, 861-865(15 May 1977).

A modified two-dimensional Korteweg-de Vries equation for a collisionless plasma consisting of two distinct ionic species and isothermal electrons has been derived. The effect of concentration of light ions on the amplitude and the width of the drift solitary wave is examined for an argon plasma and a helium plasma with hydrogen ion impurities. Similarly the effect of concentration of negative ions on the amplitude of the drift solitary wave is examined and it is shown that when negative ions are present one gets the usual compressive drift solitary waves with positive amplitude as well as rarefactive drift solitary waves with negative amplitude depending on the negative ion concentration.

**22503 Stability boundaries of an argon afterglow.** Zhilinskii, A.P.; Markelov, S.V.; Smirnov, A.S. (M. I. Kalinin Polytechnical Institute, Leningrad). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* 22: No. 5, 585-587(May 1977).

Experimental data on the stability boundaries of an Ar afterglow in a homogeneous magnetic field are reported. Two oscillation modes grow in the plasma: noisy fluctuations with a broad frequency spectrum, and low-frequency sinusoidal oscillations. The first instability arises if the parameter H/p/sup 1/2/ exceeds a certain critical value. The properties of the noisy fluctuations are described qualitatively by the theory for the drift instability of a weakly ionized plasma for perturbations with wavelengths of the order of the Debye length. The sinusoidal low-frequency oscillations exist only if p<0.1

torr and only in a narrow range of the charged-particle density and magnetic field. The range over which these oscillations exist is expanded in microwave heating of the plasma electrons.

**22504 Instabilities in the TM-3 tokamak connected with runaway electron beam.** Alikaev, V.V.; Razumova, K.A.; Sokolov, Yu.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). *Fiz. Plazmy;* **1**: No. 4, 546-555(Jul 1975). (In Russian).

In facilities of the tokamak type the presence of escaping electrons in a low-density plasma may lead to an instability, as a result of which the transverse energy of a plasma column sigma(nT)sub(tr) increases. This increase occurs due to deminishing of the longitudinal energy of escaping electrons sigmaEsub(long). The energy sigma Esub(long) while instability can be carried over a discharge chamber wall, transferred to the bulk of plasma or trasformed into the transverse enerogy of escaping electrons. The maximum estimate for the energy transferred to a wall is less than 50% of the value of sigmaEsub(lon.n) in a regime with the strong instability; as usual this fraction is about 10%. The absolute intensity of the electron-cyclotron (EC) radiation od accelerated electrons makes it possible to conclude that about 50% of the value of sigma(nT)sub(tr) is related with transformation of the longitudinal energy of accelerated electrons into the transverse one. The energy of accelerated electrons decelerated in the instability has been estimated by the Doppler shift of the EC frequency of accelerated electrons. The longitudinal energy of these electrons turns out to be 50 keV < sigmaEsub(long) > 170 keV. A small number of energetic protons appear in the development of the instability. The ratio of the energy of oscillations producing these ions to the energy in plasma can be estimated as $10^{-2}$.

**22505 Parametric amplification during interaction of stable and unstable waves.** Gol'tsova, Yu.K.; Rabinovich, M.I.; Reutov, V.P. (Nauchno-Issledovatel'skij Radiofizicheskij Inst., Gorkij (USSR)). *Fiz. Plazmy;* **1**: No. 4, 594-600(Jul 1975). (In Russian).

Parametric amplification in a plasma is studied when idle and plasma wave increases with an increment exceeding that of the parametric coupling waves. In such a situation superheterodyne amplification discussed in electroacoustics and consisting in transferring the idle wave increment to the signal one is possible. This effect is shown to take place also at the pumping frequencies less than those of the signal, and conditions of its realization are discussed. The problem on the parametric amplification of an electromagnetic wave is solved when increasing an idle plasma wave due to the beam instability. The behaviour of a signal wave while transition of the beam instability to a nonlinear stage has been found by numerical integration of trajectories of beam particles.

## PLASMA WAVE PHENOMENA

*REFER ALSO TO CITATION(S) 22416, 22420, 22429*

**22506** (LBL—6703) **Raman sidescatter instability in a nonuniform plasma.** Mostrom, M.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 15 Jul 1977. Contract W-7405-ENG-48. 334p. Dep. NTIS, PC A15/MF A01.

Thesis.

In the various laser-fusion concepts, an intense electromagnetic wave (the laser) must propagate through an underdense plasma region where it could decay, via the stimulated Raman instability, into a Langmuir plasma wave and a scattered electromagnetic wave. Results are obtained by evaluating the "Green's function" response in time and space for the scattered electromagnetic waves assuming they are initiated by a "delta-function" source. We consider the case where the temporal growth dominates the plasma wave convection. Then the scattered electromagnetic waves are governed by a single second-order Helmholtz differential equation, in the position variable along the density gradient, with a complex potential having two simple zeros (turning points) and one simple pole.

**22507 General dispersion relation for nonpotential ion harmonic waves propagating in plasmas with arbitrary $\beta$.** Stefant, R.J. (Department of Environmental Sciences, Tel-Aviv University, Ramat Aviv, Israel). *Phys. Fluids;* **21**: No. 1, 55-59(Jan 1978).

The dispersion relation for nonpotential ion harmonic waves propagating at any angle to the magnetic field in plasmas with arbitrary $\beta$ is derived for $\omega/k/\text{sub z/} >> \text{V/sub i/}$, where $\omega/k/\text{sub z/}$ is the parallel phase velocity and V/sub i/ is the ion thermal speed. It is shown that these slow waves can propagate in plasmas when the electron plasma pressure to magnetic pressure ratio $\beta/\text{sub e/}$, is much less than 1 and only in the wavenumber range $k > (\text{Pi/sub e//c})(\omega/\Omega/\text{sub e/cos}\theta)/\text{sup 1/2/}$, where Pi/sub e/ is the plasma frequency, $\Omega/\text{sub e/}$ is the electron gyrofrequency, c is the velocity of light, and $\theta$ is the propagation angle. Finally, a comparison between the properties of these slow waves and those of the fast electromagnetic ones, is given.

**22508 Pseudo-three-dimensional turbulence in magnetized nonuniform plasma.** Hasegawa, A.; Mima, K. (Bell Laboratories, Murray Hill, New Jersey 07974). *Phys. Fluids;* **21**: No. 1, 87-92(Jan 1978).

A simple nonlinear equation is derived to describe the pseudo-three-dimensional dynamics of a nonuniform magnetized plasma with $T/\text{sub e/} >> T/\text{sub i/}$ by taking into account the three-dimensional electron, but two-dimensional ion dynamics in the direction perpendicular to $B_0$. The equation bears a close resemblance to the two-dimensional Navier—Stokes equation. A stationary spectrum in the frequency range of drift waves is obtained using this equation by assuming a coexisting large amplitude long wavelength mode. The $\omega$-integrated k spectrum is given by $k/\text{sup } 1.8/(1+k^2)/\text{sup } -2.2/$, while the width of the frequency spectrum is proportional to $k^3(1+k^2)^{-1}$, where k is normalized by $c/\text{sub s//}\omega/\text{sub c i/}$. The result compares well with the recently observed spectrum in the ATC tokamak.

**22509 Ponderomotive force and dc magnetic field generation induced by laser absorption.** Woo, W.; DeGroot, J.S. (Department of Applied Science, University of California, Davis, California 95616). *Phys. Fluids;* **21**: No. 1, 124-127(Jan 1978).

A new expression for the ponderomotive force induced by high frequency electromagnetic and electrostatic waves propagating in plasma including the effects of dissipation is derived. Besides the usual irrotational leading term, a new simpler expression for the leading rotational term, which can contribute to the generation of mega-Gauss dc magnetic fields is found. The leading irrotational term is proportional to the dissipation rate and vanishes for a standing wave. This expression is applied to the absorption of a planar electromagnetic wave, with polarization in (p) or out of (s) the plane of incidence, obliquely incident onto a half-space of plasma with a linear density profile. The result for the dc magnetic field source term compares very well with the result from a two and one-half dimensional particle simulation calculation for p polarization. Direct acceleration by the resonantly excited electrostatic waves is the dominant dissipation process in this case. At high power, the dominant dissipation process for s polarization is parametric decay into plasma waves which are Landau damped by the electrons. The magnetic field source term is found to be comparable to that of p polarization.

**22510 Adiabatic modifications to plasma turbulence theories.** Catto, P.J. (Department of Mechanical and Aerospace Sciences, University of Rochester, Rochester, New York 14627). *Phys. Fluids;* **21**: No. 1, 147-148(Jan 1978).

Improved particle trajectories are employed to treat the adiabatic or Maxwell—Boltzmann response of a plasma in order to choose between contradictory prescriptions for obtaining the nonlinear dispersion relation from the linear one.

**22511 Emission of rf radiation from laser-produced plasmas.** Pearlman, J.S.; Dahlbacka, G.H. (Sandia Laboratories, Albuquerque, New Mexico 87115). *J. Appl. Phys.;* **49**: No. 1, 457-459(Jan 1978).

Radio-frequency emission from laser-produced plasmas has been observed from 1 to 330 MHz. The emission is found to be dependent on plasma and vacuum-chamber conditions. The low-frequency (1 MHz) oscillations appear characteristic of large-scale charge oscillations in the plasma.

**22512 Anisotropic fast electron emission from a microwave irradiated plasma slab.** Rumsby, P.T.; Michaelis, M.M.; Raven, A.; Motz, H. (Oxford Univ. (UK). Dept. of Engineering Science). *Phys. Lett., A;* **62**: No. 5, 347-349(5 Sep 1977).

Experimental measurements of the anisotropic electron emission from a microwave irradiated plasma slab are presented. The results indicate that electron emission is due to the occurrence of the oscillating two-stream instability.

**22513 Intense circularly polarized waves in plasmas.** Shukla, P.K.; Yu, M.Y. (Bochum Univ. (Germany, F.R.). Inst. fuer Theoretische Physik); Spatschek, K.H. (Essen Univ. (Gesamthochschule) (Germany, F.R.)). *Phys. Lett., A;* **62**: No. 5, 332-334(5 Sep 1977).

The nonlinear propagation of an intense circularly polarized electromagnetic wave in a cold plasma is investigated. A relativistic modulational instability and an exact localized solution are found.

**22514 Possible mechanism of microwave emission from a theta-pinch discharge in presence of a superimposed azimuthal magnetic field.** El-Khalafawy, T.A.; Youssef, A.M.; Gabr, A.A.; Bourham, M.A.; El-Hak, L.G.; Ternopol, A.M. (Atomic Energy Commission, Cairo (Egypt)). *Plasma Phys.;* **19**: No. 9, 845-852(Sep 1977).

The work presented is devoted to the investigation of the spatial and time correlation of the electrostatic oscillations excited in a theta-pinch plasma with a superimposed aximuthal magnetic field. The basic features of the electromagnetic radiation emitted from this discharge are also studied. The magnetic measurements, carried out during the time the electromagnetic radiation occurred, as well as the correlations obtained made it possible to conclude that electrostatic plasma oscillations are transformed into electromagnetic radi-

ation in the discharge region where the following conditions are fulfilled: ωsub(rad) approximately = (ωsub(pl)² + ωsub(eH)²)sup(1/2) where ωsub(rad) is the frequency of the radiated wave; ωsub(eH) is the electron cyclotron frequency; ωsub(pl) is the plasma frequency.

**22515 Non-linear resonant mode coupling in a three-dimensional guiding centre water bag plasma.** Gros, M.; Bertrand, P.; Baumann, G. (Nancy-1 Univ., 54 (France)). *Plasma Phys.;* **19**: No. 9, 811-816(Sep 1977).

The three-dimensional guiding centre model combined with a water bag distribution is used to study the non linear three-waves-interaction in a highly magnetized electron plasma. For this model, only decay instability occurs. An electron plasma wave propagating at an angle to the magnetic field is shown to decay into two electron plasma waves propagating at greater angles.

**22516 Parametric excitation of Langmuir waves in an inhomogeneous plasma.** Gupta, M.R. (Krishnagar Coll. (India)); Mukherjee, S. *Plasma Phys.;* **19**: No. 9, 839-844(Sep 1977).

The possibility of parametric excitation of Langmuir waves in an inhomogeneous plasma by an externally applied space dependent high frequency electric field has been investigated in the WKB approximation. It is shown that growth of waves with frequency equal to half the external field frequency is possible provided the pump field energy density is appreciably higher than the plasma thermal energy density.

**22517 Formation of upper-hybrid solitons.** Yu, M.Y.; Shukla, P.K. (Bochum Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). *Plasma Phys.;* **19**: No. 9, 889-893(Sep 1977).

The interaction of an electrostatic wave near the upper-hybrid resonance frequency with low-frequency electrostatic ion cyclotron perturbations is considered. It is shown that this interaction leads to the formation of the near-sonic upper-hybrid envelope solitons.

**22518 Suppression of the plasma oscillation by a wave perturbation on the beam distribution function.** Amemiya, H. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). *Phys. Lett., A;* **62**: No. 4, 220-222(22 Aug 1977).

The suppression of naturally excited waves by an externally applied wave in the travelling wave type of beam-plasma interaction is shown to be due to a wave perturbation on the beam distribution function experimentally.

**22519 Obliquely propagating whistler mode waves in cold plasmas permeated by dilute low-$\beta$ anisotropic plasmas.** Hashimoto, K.; Kimura, I. (Kyoto Univ. (Japan)). *J. Plasma Phys.;* **18**: 1-14(Aug 1977).

The growth rate of obliquely propagating whistler mode waves in a cold plasma that also contains some hot electrons in a bi-Maxwellian distribution is analysed. Approximate analytic expressions for the growth rate are derived explicitly. They are represented by elementary functions only, consisting of a Landau damping term and a cyclotron instability term. They are found to be valid for a wide range of wave normal angles. Landau damping in the oblique propagation does not always become larger even if the wave normal angles increases. The necessary conditions for the minimal parallel growth are ω > 0.5Ωsub(e) and Tsub(perpendicular to) > 2Tsub(parallel to) in the bi-Maxwellian hot plasma. This method is applied to calculations of the net growth along the ray paths of obliquely propagating non-ducted whistler mode waves in a model magnetosphere.

**22520 Renormalization method and singularities in the theory of Langmuir turbulence.** Pelletier, G. (Grenoble-1 Univ., 38 (France)). *J. Plasma Phys.;* **18**: 49-76(Aug 1977).

The method of renormalization, using propagators and diagrams, is recalled with enough mathematical details to be read and used by a non-specialist. The Markovian models are discussed and applied to plasma turbulence. The physical meaning of the diagrams is exhibited. In addition to the usual resonance broadening, an improved renormalization is set out, including broadening of the nonlinear resonance with a beat wave by induced scattering. This improved renormalization is emphasized. In the case of Langmuir turbulence, it removes difficulties arising at the group velocity, and enhances large-scale induced-scattering diffusion.

**22521 Modulation of randomly phased whistler wave packets by kinetic Alfven and ion quasi-modes in a magnetized plasma.** Shukla, P.K. (Bochum Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). *J. Plasma Phys.;* **18**: 155-164(Aug 1977).

The nonlinear coupling of stationary whistler wave turbulence with low-frequency kinetic Alfven and ion quasi-modes in a magnetized plasma is considered. It is found that such couplings lead to instabilities. The influence of various plasma parameters on the linear growth rate of the instabilities is obtained. The results may be useful to the understanding of numerous phenomena associated with electron whistler waves in space and laboratory plasmas.

**22522 Solitary electrostatic ion cyclotron waves.** Yu, M.Y. (Bochum Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). *J. Plasma Phys.;* **18**: 139-143(Aug 1977).

It is shown that solitary electrostatic ion cyclotron waves exist. An explicit solution is presented for the case of propagation near the ion-acoustic speed.

**22523 Effects of hydrogen impurities on shock structure and stability in ionizing monatomic gases. II. Krypton.** Glass, I.I.; Liu, W.S.; Tang, F.C. (Toronto Univ., Ontario (Canada). Inst. for Aerospace Studies). *Can. J. Phys.;* **55**: No. 14, 1269-1279(15 Jul 1977).

At shock Mach numbers Msub(s) >= 15 in pure krypton, at initial pressures $p_0$ approximately 5 Torr, and final electron number densities nsub(e) approximately $10^{17}$ $cm^{-3}$, the translational shock front in a 10 cm x 18 cm hypervelocity shock tube develops sinusoidal instabilities which affect the entire shock structure including the ionization relaxation region, the electron-cascade front and the final quasiequilibrium state. The sinusoidal instabilities investigated here may offer some important clues to the abatement of instabilities that lead to detonations and explosions.

**22524 New approach of studying electromagnetic mode coupling in inhomogeneous magnetized plasma. I. Normal incidence.** Cheng, F.T.; Fung, P.C.W. (Hong Kong Univ.). *Astrophys. Space Sci.;* **49**: No. 2, 367-388(Jul 1977).

In this paper a new approach is used to derive the system of first-order coupled equations governing the propagation of electromagnetic waves in an inhomogeneous magnetized plasma for normal incidence. In this new approach a step model is employed and Maxwell's equations are used indirectly. The method presented possesses simplicity in mathematical manipulation and gives a clearer physical picture of the mechanism of mode-coupling. The variables Esub(i) used in the coupled equations are directly related to experimental measurements. The results is shown to be equivalent to that obtained by Budden and Clemmow (1957).

**22525 Equation of polarization transfer in an inhomogeneous magnetized plasma. I. Formalism.** Cheng, F.T.; Fung, P.C.W. (Hong Kong Univ.). *Astrophys. Space Sci.;* **49**: No. 2, 427-442(Jul 1977).

In an inhomogeneous magnetized plasma, the polarization characteristics of electromagnetic waves can vary in the course of propagation due to emission from the medium, Faraday rotation, differential absorption of characteristic modes, mode coupling and inhomogeneity of the medium. The polarization transfer equation is formulated in tensorial form including terms describing the five stated phenomena. Explicity expressions for the relevant coefficients describing the different physical processes are given and some properties of the transfer equation are discussed.

**22526 Resonant particles at a wave front in a weakly inhomogeneous plasma.** Davydovskii, V.Y. (V. D. Kalmykov Taganrod Radiotechnical Institute). *Sov. Phys. - Tech. Phys. (Engl. Transl.);* **22**: No. 5, 540-543(May 1977).

The average longitudinal force due to the field inhomogeneity at a plane wave front moving in an electron—proton plasma can cause reflection of charged particles. As a result, a longitudinal electrostatic field appears at the wave front. In the accelerated motion of a front in an inhomogeneous medium, the reflected particles are accelerated by repeated collisions with the front. The energy spectrum of the accelerated particles is similar to the observed cosmic-ray spectrum.

**22527 Convective excitation of quasistatic waves in an inhomogeneous anisothermic plasma. II. Nonlinear estimates.** Jungwirth, K.; Sizonenko, V.L. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). *Czech. J. Phys.;* **27**: No. 4, 402-417(1977).

Nonlinear effects stabilizing the convective instabilities excited in an anisothermic plasma (Tsub(e)>>Tsub(i)) at the plasma boundary (a< or approximately Vsub(s)/ωsub(Bi)) are discussed. Waves having in the linear theory (Part I) the highest growth rates (γ>>ωsub(Bi)) saturate at first. Being excited by a small part of slow plasma electrons (vsub(z)<<vsub(Te)) only, they saturate at a relatively low level. Further, surface waves with lower frequencies and higher phase velocities (vsub(ph)=ω/ksub(z)) become dominant and a broadening of the plasma boundary occurs. For their saturation nonlinear interaction is more important than the quasilinear effects. During the time interval of several ωsub(Bi)sup(-1) the longest surface waves with ksub(y) approximately ωsub(Bi)/Vsub(s), γ approximately ω approximately ωsub(Bi) approximately ksub(y)Vsub(s) and vsub(ph) approximately vsub(Te) saturate at the absolutely highest level. The plasma boundary broadens in the meanwhile up to a approximately Vsub(s)/ωsub(Bi). The wave energy is comparable to the total energy connected with the longitudinal motion of the initially thermal electrons inside this boundary layer. The wave amplitude is large enough to trap the initially cold ions belonging to this layer and 'heat' them up to energies comparable to those of the electron component. The heating process again occurs within several ωsub(Bi)sup(-1) and the Larmor radius of the

ions is then comparable to Vsub(s)/ωsub(Bi). Further evolution of the system is governed by the unstable local perturbations.

**22528 Outer shock structure of shock-waves propagating in partially ionized gases.** Greywall, M.S.; Kabadi, J.N. (Wichita State Univ., KS). *Int. J. Eng. Sci.;* **15**: No. 12, 701-705(1977).

Structure of a shock wave propagating through a partially ionized gas is divided into an inner heavy particle shock and two surrounding outer regions. The electron and heavy particle properties are calculated at the two edges of the inner shock and are found to vary, for a given free stream Mach number $M_1$, almost linearly with the degree of ionization. The Mach number that characterizes the inner shock decreases monotonically from $M_1$ as the degree of ionization increases and reaches a limiting value, for a given $M_1$, as the gas becomes fully ionized. The width of the outer regions is found to be of the order of length for electron heat conduction when this conduction is equal to the convected internal energy.

**22529 High-frequency diamagnetism and three-dimensional cyclotron solitons in a plasma.** Petviashvili, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). *Zh. Eksp. Teor. Fiz., Pis'ma Red.;* **23**: No. 12, 682-684(20 Jun 1976). (In Russian).

**22530 Raman scattering and two-plasmon instability in laser-created plasmas.** Bobin, J.J. (Commis l'Engerg At, C.E.L. Villeneuve St. Georges, Fr). *Opt. Commun.;* **14**: No. 3, 339-343(Jul 1975).

Couplings in which a plasma wave can be generated through either one of two mechanisms are investigated. It is shown that the Raman up-conversion associated with the two-plasmon decay might account for the observation of the $3\Omega_0/2$ harmonic. 15 refs.

**22531 Some models of wave collapses.** Budneva, O.B.; Zakharov, V.E.; Synakh, V.S. (AN SSSR, Chernogolovka. Inst. Teoreticheskoj Fiziki). *Fiz. Plazmy;* **1**: No. 4, 606-613(Jul 1975). (In Russian).

The results of numerical experiments on studying spheric-symmetric wave collapses are presented and discussed in the framework of equations describing the nonstationary focusing of light and the dynamics of Langmuir waves in a plasma.

**22532 Nonlinear dissipation effects on spectra of the strong Langmuir turbulence.** Gorev, V.V.; Kingsep, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). *Fiz. Plazmy;* **1**: No. 4, 601-605(Jul 1975). (In Russian).

The interaction of Langmuir solitons with taking account of nonlinear damping on plasma particles is considered. Nonlinear dissipative effects are shown to lead to the accumulation of large-amplitude solitons in a plasma. As a result spectrum Wsub(k) approximately $k^{-2}$ known from the hydrodynamics transforms into spectrum Wsub(k) approximately (1-krD) at sufficiently weak pumping of energy.

**22533 Dynamics of collapse of Langmuir waves in hot plasma.** Zakharov, V.E.; Mastryukov, A.F.; Synakh, V.S. (AN SSSR, Novosibirsk. Vychislitel'nyj Tsentr; AN SSSR, Chernogolovka. Inst. Teoreticheskoj Fiziki). *Fiz. Plazmy;* **1**: No. 4, 614-622(Jul 1975). (In Russian).

The fact of the collapse formation is established within the framework of equations for the high-temperature plasma dynamics averaged over the period of Langmuir electron oscillations. The development of a collapse is analysed and its model character is shown. Theoretical estimates are verified and substantiated in numerical experiments for two geometries: flat and axial-symmetric.

## FUSION POWER PLANT TECHNOLOGY

**22534** (CONF-771029—150) **Oak Ridge TNS Program 1976—1977. Integration of engineering reality brings us closer to realizable reactor.** Roberts, M. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 6p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

Both the techniques and results of bringing engineering reality into the exploration of the possible design choices for The Next Step (TNS) in the Tokamak Fusion Program after TFTR are discussed in this report. Each of the elements of our interrelated, three-part approach—plasma engineering, engineering design, and program planning—is highlighted. The constraints developed from an engineering viewpoint are seen to stimulate creative improvements in each area. Plasma engineering activities that reduce technological requirements for reactor core performance are described. The engineering design study comparing quantitatively various technical options for TF coils is outlined with summarized findings leading to a clearer view of the essential problems—namely the setting of objectives and making of decisions. The findings of the draft program planning exercise are also presented.

**22535** (CONF-771029—190) **Plasma engineering studies for the tokamak experimental power reactor.** Stacey, W.M. Jr.; Brooks, J.N.; Evans, K. Jr.; Todd, A.M.M. (Argonne National Lab., Ill. (USA); Princeton Univ., N.J. (USA). Plasma Physics Lab.). 1977. Contract W-31-109-ENG-38. 7p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

This paper describes plasma engineering studies made in support of a revised version of a tokamak experimental power reactor (EPR). These include: (1) magnetohydrodynamic (MHD) equilibrium and stability calculations, which establish the ranges of β/sub t/ and the corresponding MHD parameters; (2) particle and power balance calculations, which are used for sizing and trade-off studies; and (3) burn cycle dynamics calculations, which determine start-up and driving systems requirements and reactor net power output. The resulting EPR reference design is described.

**22536** (CONF-771109—57) **ELMO Bumpy Torus.** Dandl, R.A.; Dory, R.A.; Uckan, N.A. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 6p. Dep. NTIS, PC A 02/MF A01.

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

The present understanding of equilibrium, stability, and transport in EBT suggests a sequence of research and development activities aimed at a full-scale reactor. The EBT program includes an aggressive development effort for high-power millimeter CW microwave sources based on the Cyclotron Resonant Maser principle. The existing physics evidence suggests that the EBT approach can be extended to confine steady-state, high-beta (toroidal) plasmas. If this extension is demonstrated, then EBT offers an attractive alternative to the tokamak and magnetic mirror for controlled thermonuclear fusion. Some of the critical scientific and technology factors that require resolution as preconditions to reactor feasibility are listed. (MHR)

**22537** (CONF-771109—65) **Design features of the ELMO Bumpy Torus Reactor (EBTR).** Uckan, N.A.; Bettis, E.S.; Hedrick, C.L.; Santoro, R.T.; Yeh, H.T.; Watts, H.L.; McAlees, D.G. (Oak Ridge National Lab., Tenn. (USA); Exxon Nuclear Co., Inc., Richland, Wash. (USA)). 1977. Contract W-7405-ENG-26. 6p. Dep. NTIS, PC A02/MF A01.

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

The essential features of the EBTR described are: plasma engineering and physics, magnetics, mechanical design and neutronics. A time-dependent D-T plasma model was formulated to simulate the dynamic behavior of the system and to provide a framework for testing physics assumptions and models. The main goal in the magnetics areas was to satisfy the plasma constraints with a coil design which could be built with existing technology. Conceptual design of EBT reactors based on the modular concept (with identical superconducting coils) was studied for a wide range of sizes, i.e., for major radii between 30 m and 120 m. The nuclear performance of the blanket was evaluated using a one-dimensional analysis. (MHR)

**22538** (DOE/ET—0002) **Perspectives on the development of fusion power by magnetic confinement, 1977.** (Department of Energy, Washington, D.C. (USA). Div. of Magnetic Fusion Energy). 1977. 7p. Dep. NTIS, PC A02/MF A01.

The Committee concludes: that recent progress of the magnetic fusion energy program provides a tangible basis for the belief that the development of fusion power will prove feasible; that the primary near-term objective of the program should now be to demonstrate actual reactor-level conditions; and that the potential long-term benefits of fusion power are sufficiently great to warrant a sustained national effort to advance the fusion power option to the stage of commercial availability at an early time.

**22539** (UCRL—79653) **Laser driven fusion fission hybrids.** Hansen, L.F.; Maniscalco, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jul 1977. Contract W-7405-ENG-48. 35p. (CONF-771102—14). Dep. NTIS, PC A03/MF A01.

From 20. annual AICHE meeting; New York, NY, USA (13 Nov 1977).

The role of the fusion-fission hybrid reactor (FFHR) as a fissile fuel and/or power producer is discussed. As long range options to supply the world energy needs, hybrid-fueled thermal-burner reactors are compared to liquid metal fast breeder reactors (LMFBR). A discussion of different fuel cycles (thorium, depleted uranium, and spent fuel) is presented in order to compare the energy multiplication, the production of fissile fuel, the laser efficiency and pellet gain requirements of the hybrid reactor. LLL has collaborated with Bechtel Corporation and with Westinghouse on the conceptual design of laser fusion power plants. The neutronic studies of these two designs are discussed. The operational parameters, such as energy multiplication, power density, burn-up and plutonium production as a function of time, are also presented.

**22540** (UCRL—79870) **Mirror machine program in the USA.** Coensgen, F.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Sep 1977. Contract W-7405-ENG-48. 11p. (CONF-770906—9). Dep. NTIS, PC A02/MF A01.

From 8. European conference on controlled fusion and plasma physics; Prague, Czechoslovakia (19 Sep 1977).

As the result of recent experimental progress, theoretical advances, and the emergence of new approaches to the improvement of mirror confinement, the mirror approach has become the principal alternative to the tokamak in the USA magnetic fusion program. Emphasis is now centered on the Tandem Mirror and Field-reversed Mirror Concepts, which theoretically can obtain Q values of five or more. Recent progress in the mirror fusion program includes a series of favorable advances in the 2XIIB experiment and the development of a theoretical model that accounts for observed plasma behavior in 2XIIB and other mirror experiments. This theory provides scaling laws for extrapolating of present experiments to larger devices. These advances, together with the emergence of new approaches to the improvement of mirror confinement, have led to increased planning and construction of magnetic mirror systems in the USA. The USA mirror program is shown including several university experiments.

**22541** (UCRL—80075) **Tandem mirror reactor.** Moir, R.W.; Barr, W.L.; Carlson, G.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Nov 1977. Contract W-7405-ENG-48. 17p. (CONF-771056—5). Dep. NTIS, PC A02/MF A01.

From IAEA conference and workshop on fusion reactor design; Madison, WI, USA (12 Oct 1977).

A parametric analysis and a preliminary conceptual design for a 1000 MWe Tandem Mirror Reactor (TMR) are described. The concept is sufficiently attractive to encourage further work, both for a pure fusion TMR and a low technology TMR Fusion-Fission Hybrid.

**22542** (UCRL—80076) **Mirror hybrid (fusion—fission) reactor.** Bender, D.J.; Lee, J.D.; Neef, W.S.; Devoto, R.S.; Galloway, T.R.; Fink, J.H.; Schultz, K.R.; Culver, D.; Rao, S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1977. Contract W-7405-ENG-48. 17p. (CONF-771056—9). Dep. NTIS, PC A02/MF A01.

From IAEA conference and workshop on fusion reactor design; Madison, WI, USA (12 Oct 1977).

The reference mirror hybrid reactor design performed by LLL and General Atomic is summarized. The reactor parameters have been chosen to minimize the cost of producing fissile fuel for consumption in fission power reactors. As in the past, we have emphasized the use of existing technology where possible and a minimum extrapolation of technology otherwise. The resulting reactor may thus be viewed as a comparatively near-term goal of the fusion program, and we project improved performance for the hybrid in the future as more advanced technology becomes available.

**22543** (UCRL—80475) **Directions for possible upgrades of the Mirror Fusion Test Facility (MFTF).** Damm, C.C.; Coensgen, F.H.; Devoto, R.S.; Molvik, A.W.; Porter, G.D.; Shearer, J.W.; Stallard, B.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Dec 1977. Contract W-7405-ENG-48. 17p. (CONF-771213—5). Dep. NTIS, PC A02/MF A01.

From Plasma heating development requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

The Mirror Fusion Test Facility (MFTF) may be upgraded by extending the time of plasma sustenance in an approach to steady-state operation and/or by increasing the neutral-beam injection energy. Some parameter bounds for these upgrades are discussed as they relate to a definition of the required neutral-beam development.

**22544** (WFPS-TME—062) **Computer code for the costing and sizing of TNS tokamaks.** Sink, D.A.; Iwinski, E.M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Fusion Power Systems Dept.). 30 Sep 1977. Contract W-7405-ENG-26. 20p. (CONF-771029—196). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

A FORTRAN code for the COsting And Sizing of Tokamaks (COAST) is described. The code was written to conduct detailed analyses on the engineering features of the next tokamak fusion device following TFTR. The ORNL/Westinghouse study of TNS (The Next Step) has involved the investigation of a number of device options, each over a wide range of plasma sizes. A generalized description of TNS is incorporated in the code and includes refined modeling of over forty systems and subsystems. Considerable detailed design and analyses have provided the basis for the thermal, electrical, mechanical, nuclear, chemical, vacuum, and facility engineering of the various subsystems. Currently, the code provides a tool for the systematic comparison of four toroidal field (TF) coil technologies allowing both D-shaped and circular coils. The coil technologies are: (1) copper (both room temperature and liquid-nitrogen cooled), (2) superconducting NbTi, (3) superconducting $Nb_3Sn$, and (4) a Cu/NbTi/ hybrid. For the poloidal field (PF) coil systems copper conductors are assumed. The ohmic heating (OH) coils are located within the machine bore and have an air core, while the shaping field (SF) coils are located either within or outside the TF coils. The PF coil self and mutual inductances are calculated from the geometry, and the PF coil power supplies are modeled to account for time-dependent profiles for voltages and currents as governed by input data. Plasma heating is assumed to be by neutral beams, and impurity control is either passive or by a poloidal divertor system. The size modeling allows considerable freedom in specifying physics assumptions, operating scenarios, TF operating margin, and component geometric and performance parameters. Cost relationships have been developed for both plant and capital equipment and for annual utility and fuel expenses. The code has been used successfully to reproduce the sizing and costing of TFTR in order to calibrate the various models.

**22545** **Fusion moves from plasma physics research to reactor engineering.** Moss, J. *Nucl. Eng. Int.;* **22**: No. 261, 33-35(Aug 1977).

Confidence that demonstration fusion power reactors will be working by the end of the century was the keynote of the discussion on thermonuclear plants and their associated electrical equipment at the World Electrotechnical Congress held in Moscow from 21-25 June. This applies to both the tokamak and pulsed power systems in the view of Soviet and American scientists whose contributions dominated the discussion. A brief synopsis is given of some of the programmes described.

**22546** **Clean fusion concepts and efforts: a survey.** Best, R.W.B. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica). *Nucl. Instrum. Methods;* **144**: No. 1, 1-7(1 Jul 1977).

Fusion reactors as presently conceived are breeders of tritium and, possibly, plutonium as well; a single reactor produces hundreds of tons of radioactive waste per year. Comparatively clean fusion fuels which avoid the production of radioactive matter are reviewed, together with the physical concepts how these fuels can be burnt. The main problems are bremsstrahlung and ion cooling in the presence of electrons, and low power density in the absence of electrons. Laser compression of pellets of a mixture of protons and boron-11 may be a solution when lasers in the megajoule range become available. Other valuable R and D efforts are clamped beam-plasma devices, the migma cell, and direct converters.

**22547** **Are generalized or unified criteria possible.** Decker, J. (Energy Research and Development Administration, Washington, D.C. (USA). Div. of Controlled Thermonuclear Research). *Nucl. Instrum. Methods;* **144**: No. 1, 81-86(1 Jul 1977).

The author discusses some of the considerations that are used by ERDA in funding fusion concepts. There are a number of physics questions that are common to almost all of the concepts submitted for funding, e.g. questions of equilibrium, stability in configuration, what is the energy transport, is there a heating mechanism that is viable. The author lists four stages of fusion research and discusses the considerations used to provide funding for these stages.

**22548** **1976 status of the migma program of controlled fusion.** Maglich, B.C. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **144**: No. 1, 33-42(1 Jul 1977).

The objective of the migma program of controlled fusion is to build, using the existing, commercially available technology, a prototype demonstration power plant, generating continuously at least 1 kW of fusion power. It is estimated that this can be accomplished in five years, with about 60 million dollars.

**22549** **Impact of advanced fuel fusion on electric power transmission.** de Mello, R.W.; Reppen, N.D.; Ringlee, R.J.; Wilson, D.D. (Power Technologies, Inc., Schenectady, New York, USA). *Nucl. Instrum. Methods;* **144**: No. 1, 43-48(1 Jul 1977).

Although prototypes of advanced fuel fusion plants may be many years off, it is useful to consider the ways in which such devices may be integrated within electric power production and distribution systems. This discussion examines some of the characteristics of the electric power supply systems which impact the application of new energy sources. One of the probable advantages of nuclear fusion plants is greater freedom for plant site selection when compared to nuclear fission LWR plants and coal fired fossil-steam plants. Should direct conversion prove feasible, a 'clean' fusion energy plant might be located underground within urban centers. Fusion-steam plants might also be located within urban areas and uses found for the significant quantities of heat which must be released at relatively low temperatures. Although early design considerations may not warrant detailed analyses of technical plant and transmission requirements, broad economic assessments pertaining to point of application and demand requirements upon the energy source should be incorporated in evaluations of advanced fuel fusion processes.

**22550 Potential of controlled nuclear fusion.** Pease, R.S. (UKAEA, Culham Lab, Abingdon, Berkshire, Engl). *Phys. Technol.;* **8**: No. 4, 144-151(Jul 1977).

Advances in magnetic confinement of high-temperature matter place the goal of controlled fusion within sight. The Director of the British Culham Laboratory reviews here recent progress towards achieving the thermal insulation and plasma conditions required to realize the potential of thermonuclear fusion. Refs.

**22551 Quest for fusion power.** Talwar, S.P. (Delhi Univ. (India). Dept. of Physics and Astrophysics). *Sci. Rep. (New Delhi);* **14**: No. 6, 349-353(Jun 1977).

The need to exploit nuclear fusion as a source of energy for the future is pointed out. The advantages of fusion reactions over fission reactions are mentioned. Some fusion reactions are briefly described. The principle of controlled thermonuclear devices and magnetic bottles are described. Future possibilities are indicated.

**22552 Nuclear fusion: the energy source for the future.** Brennan, M.H. (Flinders Univ. of South Australia, Bedford Park. Inst. for Energy Studies). *Search;* **8**: No. 4, 111-117(Apr 1977).

The controlled release of nuclear energy in the fusion of the light elements, particularly the heavy isotopes of hydrogen, offers the possibility of an essentially unlimited supply of cheap energy. The basic physical principles of such a fusion reactor are discussed. Several of the major current lines of research are reviewed, including the toroidal magnetic confinement approach used in the Tokamak and the inertial confinement of laser fusion. The author discusses the probable time scale for the introduction of such reactors, their environmental impact, and the availability of fuel for them.

**22553 Thermonuclear fusion power.** Lehnert, B. (Tekniska Hoegskolan, Stockholm (Sweden)). *Int. J. Heat Mass Transfer;* **1**: No. 1, 5-23(1977).

The present state and future possibilities of controlled-nuclear-fusion research are reviewed, including basic concepts and problems, as well as various approaches based on magnetic- and nonmagnetic-confinement schemes. Considerable progress has so far been made in both plasma physics and fusion -reactor technology, and a closer relationship has been established between theory and experiments. Still, none of the present approaches will, for certain, lead to the final solution of a full-scale reactor. Intensified work along broad lines, with emphasis also on basic research and new ideas, is necessary for future success.

**22554 Chemical engineering side of nuclear fusion power.** Johnson, E.F. (Princeton Univ, Plasma Phys Lab, NJ). *AIChE J.;* **23**: No. 5, 617-631(1977).

An overview is presented of the fusion development program for magnetically confined fusion power reactors and an identification of the major technological problems remaining to be solved. 61 refs.

**22555** (ORNL-tr—4530) **Design and physical principles of the finger-ring T-12 Tokamak with two axisymmetrical diverters.** Bortnikov, A.V.; Brevnov, N.N.; Gerasimov, S.N.; Zhokin, A.M.; Kazachkov, A.A.; Mazurov, V.L.; Sokolov, N.I.; Shchurov, O.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1977. Translation of IAE—2772. 29p. Dep. NTIS, PC A03/MF A01.

Two stages of the study are described. The possibility of forming a divertor layer and measuring its physical parameters in the conventional Tokamak regime with continuous hydrogen flooding is studied. In the second stage additional evacuation of the divertor volumes is employed, the divertor apertures are narrowed, and the plasma column is formed during pulsed gas injection, i.e., conditions are created for the realization of an ideal divertor in which the primary mass of particles should be captured and only a small proportion of neutral particles will return to the central chamber. (MOW)

**22556 Perspectives on fusion power commercialization.** Neff, J.O. (Energy Research and Development Administration, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 10(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22557 Commercial feasibility of fusion power based on the tokamak concept.** Reid, F.L.; Wood, W.B.; Steiner, D. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 10-11(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22558 Effects of fusion reactor size and availability on utility operations.** Badertscher, N.L.; Horgan, D.N. Jr. (Systems Control, Palto Alto, CA). *Trans. Am. Nucl. Soc.;* **27**: 14-15(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22559 Overview of near-term magnetic confinement fusion reactor designs.** Coffman, F.E.; Head, C.R. (Energy Research and Development Administration, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 20-21(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22560 TDHR-a Tokamak demonstraction hybrid reactor.** Conn, R.W. (Univ. of Wisconsin, Madison); Teofilo, V.L.; Leonard, B.R. Jr.; Perry, R.T.; Bampton, M.C.C.; McKinnon, M.A.; Bloomster, C.H.; Fassbender, L.L.; Young, J.R. *Trans. Am. Nucl. Soc.;* **27**: 26-27(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22561 Plasma engineering considerations for a medium-field ignition test reactor.** Peng, Y-K.M.; Attenberger, S.E.; Callen, J.D.; Holmes, J.A.; Houlberg, W.A. (Oak Ridge National Lab., TN); Marcus, F.B.; McNally, J.R. Jr.; Mense, A.T.; Rome, J.A.; Uckan, N.A. *Trans. Am. Nucl. Soc.;* **27**: 27-29(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22562 Status report on the current DMFE review of alternative magnetic confinement systems.** Decker, J.F. (Energy Research and Development Administration, Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 41(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22563 ELMO bumpy torus.** Dandl, R.A.; Dory, R.A.; Uckan, N.A. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 41-43(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22564 Advanced fuel bumpy tori.** Gerdin, G.A.; Southworth, F.H.; Stark, R. (Univ. of Illinois, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 43-44(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22565 SURMAC: an advanced fuel fusion reactor.** Wong, A.Y.; Schumacher, R.; Breun, R.; Miller, L.R. (Univ. of California, Los Angeles). *Trans. Am. Nucl. Soc.;* **27**: 44-45(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22566 Conceptual LINUS fusion reactor.** Robson, A.E. (Naval Research Lab., Washington, DC). *Trans. Am. Nucl. Soc.;* **27**: 45-47(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22567 Reversed-field pinch reactor (RFPR).** Hagenson, R.L.; Krabowski, R.A.; Thomassen, K.I. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 47-48(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22568 Thermonuclear fusion device LIME.** Bohachevsky, I.O. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 48-49(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22569 Status of laser solenoid fusion concept.** Hoffman, A.; Rose, P.; Steinhauer, L. (Mathematic Sciences Northwest, Inc., Bellevue, WA). *Trans. Am. Nucl. Soc.;* **27**: 49-50(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22570 Catalyzed deuterium fusion-fission hybrid reactors.** Greenspan, E. (Nuclear Research Center-Negev, Beer-Sheva, Israel). *Trans. Am. Nucl. Soc.;* **27**: 50-51(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22571 Progress in fusion technology.** Williams, J.M. (Energy Research and Development Administration, Washingston, DC). *Trans. Am. Nucl. Soc.;* **27**: 52-53(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22572 Design approaches for enchancing the engineering feasibility of tokamak power reactors.** Shannon, T.E.; Steiner, D. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 60-61(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22573 Major cost drivers for tokamak fusion power plants.** DeFreece, D.A.; Davis, J.W. (McDonnell Douglas Astronautics Co., Balliun, MO). *Trans. Am. Nucl. Soc.;* **27**: 61-62(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22574 Experiment in undergraduate education: the fusion design team.** Martin, J.G.; Brown, G.J. (Univ. of Lowell, MA). *Trans. Am. Nucl. Soc.;* **27**: 105-106(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22575 Mechanical structure of the mirror hybrid reactor power plant.** Culver, D.W. (General Atomic Co., San Diego, CA); Neef, W.S. *Trans. Am. Nucl. Soc.;* **27**: 68-69(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22576** (ORNL-tr—4531) **Research and design-construction work of the Scientific Research Institute of Electrophysical Apparatus in the field of controlled thermonuclear fusion.** Glukhikh, V.A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1977. Translation by S.D. Blalock, Jr. of NIIEFA-P—0344. 32p. Dep. NTIS, PC A03/MF A01.
This preprint examines research and design-construction work carried out on engineering problems of controlled thermonuclear fusion that have been conducted in recent years at the D. V. Yefremov Scientific Research Institute of Electrophysical Apparatus in collaboration with the I. V. Kurchatov Atomic Energy Institute and other institutes associated with the creation of thermonuclear reactors and large experimental installations.

## BLANKET ENGINEERING

*REFER ALSO TO CITATION(S) 22610, 22611, 22630, 22675*

**22577** (CONF-771029—189) **Thermal responses of tokamak reactor first walls during cyclic plasma burns.** Smith, D.L.; Charak, I. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 8p. Dep. NTIS, PC A02/MF A01.
From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).
The CINDA-3G computer code has been adapted to analyze the thermal responses and operating limitations of two fusion reactor first-wall concepts under normal cyclic operation. A component of an LMFBR computer has been modified and adapted to analyze the ablative behavior of first-walls after a plasma disruption. The first-wall design concepts considered are a forced-circulation water-cooled stainless steel panel with and without a monolithic graphite liner. The thermal gradients in the metal wall and liner have been determined for several burn-cycle scenarios and the extent of surface ablation that results from a plasma disruption has been determined for stainless steel and graphite first surfaces.

**22578** (EPRI-ER—582) **Fusion reactor first wall/blanket systems analysis: tokamak concepts.** Fuller, G.M. (McDonnell Douglas Astronautics Co., St. Louis, Mo. (USA)). Nov 1977. 264p. Dep. NTIS, PC A12/MF A01.
This document is an interim report on a systems analysis of the relationship between the design features of the first wall/blanket of a tokamak fusion power system and other major system characteristics including capital costs and the cost of electricity. The study was conducted by the McDonnell Douglas Astronautics Company-East for the Electric Power Research Institute. The report describes the results from six principal tasks which were: (1) a systematic presentation of the major features of nineteen tokamak reactor systems; (2) a development of a systems analysis computer code, TOCOMO; (3) an assessment of the trade-offs between neutron wall loading and the cost of electricity; (4) a development of techniques for predicting the structural life of the first wall; (5) an assessment of the impact of the peak coolant temperature in the reactor blanket; and (6) an assessment of first wall/blanket features as they relate to fabrication costs and scheduled maintenance activities (periodic replacement of first wall/blanket components).

**22579** (ORNL/TM—6148) **Wall power measurements of impurity radiation in ORMAK.** Bush, C.E.; Lyon, J.F. (Oak Ridge National Lab., Tenn. (USA)). Dec 1977. Contract W-7405-ENG-26. 41p. Dep. NTIS, PC A03/MF A01.
Time- and space-resolved measurements of the power loss to the liner of the Oak Ridge Tokamak (ORMAK) indicate that a large fraction (~60%) of the electron power input is lost to the wall, rather than to the limiter. This fraction is relatively constant over a wide range of input powers (ohmic heating plus neutral beam injection) and plasma conditions and for most of the discharge duration. Most of this energy loss is due to impurity radiation from an emission profile having a mean radius about a third that of the limiter radius and is time-correlated with gross plasma fluctuations, internal disruptions, and related spectroscopic impurity signals. In gas puffing experiments resulting in higher densities, the ratio of radiative power to the electron density continually falls as density increases during the course of the discharge.

**22580** (WFPS-TME—060) **Impurity and gas throughput control for TNS.** Sucov, E.W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Fusion Power Systems Dept.). 30 Sep 1977. Contract W-7405-ENG-26. 26p. (CONF-771029—197). Dep. NTIS, PC A03/MF A01.
From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).
A model of the interaction between an ignited plasma and a wall is utilized to study the impact of impurities and recycled fuel ions and helium ash on the burn time of the plasma. The model indicates that the impurity concentration, n/sub im/, grows exponentially toward a maximum value determined by the confinement time for impurities, tau/sub im/, the sputtering coefficient, S/sub i/, and the isolation coefficient, $\alpha$. The time for n/sub im/ to reach a critical value and quench the plasma was determined for representative impurities, C, Mo, W, Fe, under various conditions of plasma temperature. Methods for extending the burn time by minimizing the effective sputtering coefficient of the wall and increasing the isolation of the plasma from the wall are reviewed. The carbides, $B_4C$ and SiC, are found to have encouraging sputtering properties but their thermal, chemical and mechanical properties need to be evaluated before they can be recommended for use as first walls. The magnetic divertor is the preferred isolation scheme. Because the divertor carries impurities and leaked fuel and helium ions to a burial chamber, required pumping speeds are found to be very high for TNS plasmas and supplemental particle trapping systems must be introduced in order to reduce the required pump speed to attainable values.

**22581 Determination of fast neutron spectra with activation techniques: its application in a fusion reactor blanket model.** Kuijpers, L.; Herzing, R.; Cloth, P.; Filges, D.; Hecker, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). *Nucl. Instrum. Methods;* **144**: No. 2, 215-224(15 Jul 1977).
A suitable method for the determination of neutron spectra in a CTR-blanket model is the activation technique with threshold detectors. Unfolding of the results from the measurements yields information on the neutron spectrum in the energy range of 2.0-14.1 MeV. The SAND II unfolding program is applied; some investigations have been performed to show the influence of different data files, and of errors in cross sections and activity values. Comparisons of experimental results with values calculated by a Monte Carlo program are presented and discussed.

**22582 Unified criterion for proximity to controlled fusion.** Maglich, B.C. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **144**: No. 1, 77-80(1 Jul 1977).

The author derives a 'Lazy Lawson Criterion' incorporating about 20 energy loss terms in one efficiency parameter together with the Generalized Criterion. The combination of these two criteria is called the 'Unified Criterion'.

**22583 Generalized criterion for controlled fusion.** Miller, R.A. (Fusion Energy Corp., Princeton, N.J. (USA)). *Nucl. Instrum. Methods;* **144**: No. 1, 73-76(1 Jul 1977).

There has been increasing talk lately of the real possibility of fusion reactions as a practical source of energy for the general population. It is important both to scientific workers in the field and the general public to have a realistic yardstick for measuring distance from that goal. An early criterion was Lawson's Criterion derived 20 years ago. This says that the product of density and time must exceed a critical value to achieve energy break-even. The model used to calculate energy break-even, however, omits many important loss processes so the energy break-even is what is called 'scientific'. In the Generalized Criterion effects are included which will be present in real machines along with a method of accounting for suppression of those effects by specific designs.

**22584 First wall stress analysis for a Tokamak reactor.** Youngdahl, C.K. (Argonne National Lab., Ill. (USA)). *Nucl. Eng. Des.;* **42**: No. 2, 391-407(Jul 1977).

An outline of the general design considerations for the first wall is given, and stress analysis studies which contributed to the conceptual design of the first wall of a fusion reactor are described.

**22585 Thermalisation of energetic charged particles in fusion plasma with quantum electrodynamic considerations.** Ray, P.S.; Hora, H. (New South Wales Univ., Kensington (Australia). Dept. of Theoretical Physics). *Z. Naturforsch., a;* **32**: No. 6, 538-543(Jun 1977).

The process of energy loss of charged heavy particles in plasma has been discussed taking into consideration photon emissions by electrons of plasma during scattering as is necessitated by quantum electrodynamics. Although the range in general increases with temperature, it is found that the numerical formula of former treatment giving a range as Tsup(3/2) is not in general, obeyed. The range is susceptible to the initial energy as well as mass of the heavy particle as can be seen from the cases of alphas and reaction protons for DT, DD($\rightarrow p + He^3$) and D $He^3$ plasmas.

**22586 Wall load and lifetime goals for tokamak power plants.** Abdou, M.A. (Argonne National Lab., IL). *Trans. Am. Nucl. Soc.;* **27**: 13-14(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22587 Effects of impurities on alpha particle loss in a tokamak reactor.** Ohnishi, M.; Ao, N.; Wakabayashi, J. (Inst. of Atomic Energy, Kyoto). *Trans. Am. Nucl. Soc.;* **27**: 85-86(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22588 Plasma-wall-divertor model for tokamaks.** Stacey, W.M. Jr. (Argonne National Lab., IL). *Trans. Am. Nucl. Soc.;* **27**: 86-87(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22589 Sensitivity studies on 3.5-MeV alpha bombardment of tokamak first wall.** Hively, L.M.; Miley, G.H. (Univ. of Illinois, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 87-88(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22590 Temperature distributions in fusion reactor first-wall systems.** Charak, I. (Argonne National Lab., IL). *Trans. Am. Nucl. Soc.;* **27**: 70(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## MAGNET COILS AND FIELDS

*REFER ALSO TO CITATION(S) 22405*

**22591** (CONF-771029—149) **Mechanical design of ORPUS-3.** Schwall, R.E.; Gray, W.H.; Long, C.J. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 3p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

ORPUS-3 is the third in a series of pulsed superconducting solenoids built to test construction techniques applicable to tokamak poloidal field coils. The present coil is designed to be charged to a maximum field of 7 T in 1 sec. Stored energy is approximately 300 kJ. The conductor is a high copper-superconductor ratio mixed matrix material developed for this application. In this paper we present a mechanical design which uses distributed reinforcement to support a self-ventilating braid conductor. Using this design, it has been possible to obtain a high overall current density and a low heat flux in a fully normal zone. In order for the stress to be kept within acceptable limits in the reinforcing material, a programmed winding tension schedule has been calculated. The deflection, stress, and strain of the windings are predicted using the STANSOL-II computer code.

**22592** (CONF-771029—180) **Fast ramp superconductor for ohmic heating coils.** Walker, M.S.; Zeitlin, B.A.; Schwall, R.E. (Intermagnetics General Corp., Guilderland, N.Y. (USA); Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 5p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

Portions of document are illegible.

The present study was conducted to consider practical 10,000 ampere conductor designs to meet the operating constraints for the ohmic heating coils of TNS and experimental Tokamak reactors. The conductor must simultaneously meet the requirements for mechanical support, cryostabilization, high overall winding current density, low mechanical and electrical losses, and mechanical and electrical integrity for cyclic pulsed operation for -7 T to +7 T in one second. A suggested winding is a set of nested tubes, each made up of a stack of pancake-wound bobbins. Each pancake is co-wound of a flat open superconductor braid, steel tape, and Kapton insulation. The strands of the braid consist of sectored copper regions separated by copper-nickel and surrounding a mixed-matrix copper, copper-nickel, and NbTi multifilament core. Strands 1.5 mm in diameter provide conservative cryostabilization at overall winding current densities adequate for the OH winding of an EPR-1 or TNS sized coil (~1500 amperes/$cm^2$). Eddy current and coupling losses are at acceptable levels, and hysteresis losses can be reduced within acceptable limits with 10 $\mu$ diameter filaments, providing the winding is graded, tube to tube. The basic conductor and winding concept can be extended to provide conductors of higher currents. A 2000 ampere model conductor has been fabricated from 0.94 mm diameter strands and tested in a reinforced pancake configuration. The measured maximum recovery current corresponds to a current density of 3500 amperes/$cm^2$ over the entire coil cross section.

**22593** (CONF-771029—184) **ANL experimental program for pulsed superconducting coils.** Wang, S.T.; Kim, S.H.; Praeg, W.F.; Krieger, C.I. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 6p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

Argonne National Laboratory (ANL) had recognized the clear advantage of a superconducting ohmic-heating (OH) coil and started an aggressive development program in FY 1977. The main objectives for FY 1977 are to develop cryostable basic cable configurations with reasonably low ac losses, to develop 12 kA cryostable cable, using it to design and build a 1.5 MJ pulsed coil, and to develop a rather inexpensive large fiberglass reinforced helium cryostat for the 1.5 MJ pulsed coil. The principal objective in building the 1.5 MJ ac coil is to demonstrate ac cryostability of a large coil ranging from 2 T/s up to 12 T/s. Another objective in the pusled coil program is to determine the feasibility of parallel coil operation in order to avoid excessive voltage and current requirements and to minimize the number of turns for the equilibrium field (EF) coils, should the EF coils be connected in parallel with the OH coils. A two-coil section model using the 11 kA cable will be built and tested.

**22594** (CONF-771029—193) **Helium distribution system for the Large Coil Test Facility (LCTF).** Lawson, C.G.; May, J.R. (Oak Ridge National Lab., Tenn. (USA); Grumman Aerospace Corp., Bethpage, N.Y. (USA)). 1977. Contract W-7405-ENG-26. 4p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

The helium distribution system of the Large Coil Test Facility is designed to establish and maintain the thermal environment of the toroidal array of superconducting magnets throughout the initial test and evaluation period of the test program. The refrigeration and liquefaction requirements for the LCTF will be discussed including both the usual cooldown, lead cooling, thermal conduction and radiation and joule heating losses, and the unusual losses due to

simulated nuclear heating, magnetic coupling losses due to the transient fields of the driving magnets, and pumping losses due to fluid resistance and pump inefficiency. The flow system is designed with separate cooldown and steady-state flow systems, and to simultaneously circulate helium understeady-state conditions through coils cooled by boiling liquid or supercritical helium at approximately 4.0 K and >2.5-atm pressure. Separate helium storage dewars are utilized for vapor cooling of the current leads to the magnets with the effluent gas being stored after compression in high pressure storage tanks. The flow diagram will be presented in simplified form to show the salient features of the cryogenic system.

**22595** (CONF-771029—199) **Limits on the field of ohmic heating solenoids, applied to a tokamak TNS.** Turner, L.R. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 7p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

If the ohmic heating solenoid for the TNS or other large tokamak is an ungraded cryostable superconducting solenoid, with NbTi at 4.2 K as the superconductor, then the smallest outer diameter is not achieved at the highest attainable field. There is a lower optimum field which minimizes the outer diameter for a given volt-second requirement. At higher fields the mean diameter decreases; but the high fields require more superconductor, more copper stabilizer, more stainless steel for support, and more liquid helium coolant. For the GA-ANL design for TNS, the optimum field is 7.55 T and the minimum outside diameter for the solenoid is 2.15 m. If, on the other hand, the solenoid is graded, with more NbTi, copper, and stainless steel on the inner turns where the field is higher, than the volt-seconds can always be increased, for a given outer diameter, by adding more turns at a higher field inside until either the critical field is reached or the solenoid bore is filled. However, the material and money required to add a few more volt-seconds increases rapidly with field.

**22596** (UCID—17691) **Reassessment of the requirements to obtain field reversal in mirror machines.** Baldwin, D.E.; Fowler, T.K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Dec 1977. Contract W-7405-ENG-48. 22p. Dep. NTIS, PC A02/MF A01.

Requirements to obtain field reversal by neutral injection are re-examined to take account of a cancellation of currents at a field null caused by electron-ion collisions that drag the electrons along with the moving ions. We find that for cases of interest even a small admixture of higher-Z ions generates a residual current (the Ohkawa current) that is sufficient to maintain field reversal in steady state with a lifetime comparable to the usual magnetic diffusion time. An approximate prescription is given for buildup to such a state; namely, the neutral injection current must be sufficient to reduce the field to zero on axis with open confinement for an initial plasma radius of $r_1$ = 4r/sub Li/, where r/sub Li/ is the ion Larmor radius in the vacuum field. Again high-Z ions are needed to bring about the transition to a field-reversed state, $r_1$ = 4r/sub Li/ being the initial radius that minimizes the injection current needed to do this for a reasonable high-Z ion content (10% helium, or less of a higher-Z gas). Since 4r/sub Li/ is about 2 times the radius in past 2XIIB experiments, it is concluded that either the injection current or the energy confinement time must be substantially increased, by about a factor of 3, if field reversal is to be achieved in 2XIIB. Auxiliary injection by pulsed ion sources or plasma guns might reduce the current requirements significantly if 6 kilojoules of energy could be deposited in the plasma.

**22597** (WFPS-TME—059) **Thermal design and analysis of superconductors for the toroidal field coils of TNS.** Lee, A.Y. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Fusion Power Systems Dept.). 30 Sep 1977. Contract W-7405-ENG-26. 24p. (CONF-771029—200). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

The toroidal field coils in two of the four TNS field coil design options are superconducting. NbTi superconductors are used in the low field design option and $Nb_3Sn$ superconductors are used in the high field design option. The preliminary conceptual design parameters of the coils and the superconductors have been developed. The selected coil shape is the pure tension D-configuration. The superconductors are the multifilamentary, cabled design and are cooled by forced flow supercritical helium. Thermal stability analyses were performed for the superconductors. The cryogenic recovery capability of the NbTi superconductors is more than $10^5$ J/m$^3$ of conductor plus helium volume and that of the $Nb_3Sn$ is more than 3 x $10^6$ j/m$^3$.

**22598** **Computer simulation of field reversal in mirror machines.** Byers, J.A. (Department of Physics, Lawrence Livermore Laboratory, Livermore, California 94550). *Phys. Rev. Lett.;* **39**: No. 23, 1476-1480(5 Dec 1977).

Computer simulation of neutral injection into a mirror machine shows the existence of stable two-dimensional (r, z) field-reversed mirror configurations. The code follows ion orbits in self-consistent magnetic fields; all electron currents have been ignored. For small systems only a few gyroradii in extent, it is only necessary to focus the neutral beam of axis. Stability to the Alfven ion cyclotron mode is due in part to finite-length effects. Some steady states for large systems have also been observed.

**22599** **Numerical methods for studying compressed magnetic field generators.** Freeman, J.R.; Thompson, S.L. (Plasma Theory Division, Sandia Laboratories, Albuquerque, New Mexico 87115). *J. Comput. Phys.;* **25**: No. 4, 332-352(Dec 1977).

Explosively driven compressed magnetic field (CMF) power supplies have been used for a variety of applications. A two-dimensional MHD computational model, entitled COMAG, has been constructed to study the characteristics of helically wound CMF generators. The code combines an existing Eulerian materials response code with a two-dimensional (2D) magnetic field solver to compute the self-consistent interaction between the field and the conductors, including magnetic forces, Joule heating, and nonlinear resistive diffusion. Sample results are presented.

**22600** **Compact high-field ignition test reactor (HFITR) using bitter magnets.** Cohn, D.R.; Cook, D.L.; Kaplan, D.; Kreischer, K.; Montgomery, D.B.; Parker, R.R.; Williams, J.E.C.; Weggel, C. (Massachusetts Inst. of Tech., Cambridg); Jassby, D.L.; Okabayashi, M. *Trans. Am. Nucl. Soc.;* **27**: 25-26(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22601** (UCRL-Trans—11290) **Control of the formation of a compact toroidal structure with a pulsed barrier field.** Es'kov, A.G.; Kalygin, A.G.; Kurtmullaev, R.Kh.; Kurtuzov, M.I.; Laukhin, Ia.N.; Maliutin, A.I.; Markin, A.E.; Proshletsov, A.P.; Semenov, V.N. 1976. Translation of Paper No. IAE—2750. 17p. Dep. NTIS, PC A02/MF A01.

This work continues studies of a thermonuclear system with a compact toroidal structure and shock heating of the plasma by a poloidal field. Results are presented from an experiment on suppression of radial losses of plasma and magnetic flux in the phase of inversion of the external field and switching of oppositely directed magnetic fluxes by a pulsed quadrupole field. Calculations and results of computer simulation of heating are presented, based on longitudinal shock compression of a toroidal plasma in coaxial and volumetric versions.

## POWER SUPPLIES, ENERGY STORAGE

**22602** (LBL—6382) **SCR series switch and impulse crowbar at the Lawrence Berkeley Laboratory for CTR neutral beam source development.** Franck, J.V.; Arthur, A.A.; Brusse, L.A.; Low, W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1977. Contract W-7405-ENG-48. 6p. (CONF-771029—172). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

The series switch is designed to operate at 120kV and pass 65A for 0.5 sec every 30 sec on the Lawrence Berkeley Laboratory CTR Neutral Beam Source Test Stand IIIB. The series switch consists of 400 individual SCR circuits connected in series and is turned on by a simple system of cascaded pulse transformers with multiple single turn secondaries each driving the individual SCR gates. It is turned off by an SCR impulse crowbar that momentarily shorts the power supply allowing the series switch to recover. The SCR switch has been tested in the impulse crowbar configuration and will reliably commutate up to 90A at 120kV. The series switch and impulse crowbar are now in service in Test Stand IIIB. A series switch and impulse crowbar similar in concept is routinely powering a 10 x 10 cm source at 150kV, 20A, 0.5 sec with a 1% duty cycle on the Lawrence Berkeley Laboratory CTR NSB Test Stand IIIA.

**22603** (ORNL/TM—6079) **ORMAK upgrade ohmic coil generator protection.** Campen, G.L.; Easter, R.B.; Nickels, L.E. (Oak Ridge National Lab., Tenn. (USA)). Jan 1978. Contract W-7405-ENG-26. 66p. Dep. NTIS, PC A04/MF A01.

This report describes methods which can be used to limit the voltage across the generator for normal operation and various ground faults. It also contains quantitative information, obtained from the computer study, which can be used for evaluating the protection methods cost-wise.

**22604** (ORO—5594-9) **TEXT Energy Storage System.** Weldon, W.F.; Rylander, H.G.; Woodson, H.H. (Texas Univ., Austin (USA)). 1977. Contract EG-77-S-05-5594. 14p. Dep. NTIS, PC A02/MF A01.

The Texas Experimental Tokamak (TEXT) Enery Storage System, designed by the Center for Electromechanics (CEM), consists of four 50 MJ, 125 V homopolar generators and their auxiliaries and is designed to power the toroidal and poloidal field coils of TEXT on a two-minute duty cycle. The four 50 MJ generators connected in series were chosen because they represent the minimum cost configuration and also represent a minimal scale up from the successful 5.0 MJ homopolar generator designed, built, and operated by the CEM.

**22605** (WFPS-TME—064) **EPR ohmic heating energy storage.** Heck, F.M.; Stillwagon, R.E.; King, E.I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Fusion Power Systems Dept.). 30 Sep 1977. Contract W-7405-ENG-36. 24p. (CONF-771029—174). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

The Ohmic Heating (OH) Systems for all the Experimental Power Reactor (EPR) designs to date have all used temporary energy storage to assist in providing the OH current charge required to build up the plasma current. The energies involved ($0.8 \times 10^9$ J to $1.9 \times 10^9$ J) are so large as to make capacitor storage impractical. Two alternative approaches are homopolar dc generators and ac generators. Either of these can be designed for pulse duty and can be made to function in a manner similar to a capacitor in the OH circuit and are therefore potential temporary energy storage devices for OH systems for large tokamaks. This study compared total OH system costs using homopolar and ac generators to determine their relative merits. The total system costs were not significantly different for either type of machine. The added flexibility and the lower maintenance of the ac machine system make it the more attractive approach.

**22606** **High power pulse compression techniques.** Stewart, A.G. US Patent 4,003,007. 11 Jan 1977. Filed date 13 Nov 1975. 5p.

A method and apparatus are described for compressing high intensity current pulses and for providing an impedance transformation which increases the magnitude of the current of the pulses. A pulse is injected into a transmission line and after the pulse energy is converted to entirely electrostatic form the transmission line is discharged along the length thereof instead of out the end. The transmission line may be longitudinal, or in the shape of a torus, and the discharging may be either synchronous or asynchronous. The method and apparatus may be useful in compressing deuterium/tritium pellets to the point of nuclear burn. (Author)

## COOLING SYSTEMS

**22607** (CONF-771029—153) **Low-noise control valve. II.** Christie, R.S. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Oct 1977. Contract EY-76-C-02-3073. 8p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

There was a concern the sliding gate portion of the control valve may damage the ends of the small bore tubes used in the body of the valve. This concern prompted removal of the valve for inspection after a few months of operation. The inspection revealed a fair percentage of closed and partially closed tubes, caused by galling when the gate, which was in contact with the tube ends due to the 130 psi pressure drop through the valve, traversed across the face of the tube bundle. The tubes were repaired by machining the end of the bundle just enough to open all tubes. A "rolling" gate, mentioned previously as being in the design stage, was completed and installed on the valve. Here, the design and operation of this unique rolling closure is described and illustrated. The use of this type closure results in no damage to tube ends, reduced operator size, and smooth trouble free operation.

**22608** (UCRL—80424) **Liquid metal requirements for inertial confinement fusion.** Meier, W.R.; Maniscalco, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1977. Contract W-7405-ENG-48. 35p. (CONF-780308—3). Dep. NTIS, PC A03/MF A01.

From NACE meeting on corrosion; Houston, TX, USA (6 Mar 1978).

The lithium waterfall reactor is described as a concept in which liquid lithium serves as the coolant, tritium breeder, and 1st-wall and blanket structure protector. This reactor has emerged as a promising concept that alleviates the major problems associated with inertial confinement fusion systems. It eliminates the first wall problems resulting from x-rays and pellet debris, and minimizes cyclical thermal stresses. Also, the thick falling region of lithium attenuates neutrons to the point where the blanket structure could survive for the lifetime of the power plant at high power densities.

**22609** **Local properties of vertical mercury-argon two-phase flow in a circular tube under transverse magnetic field.** Michiyoshi, I.; Funakawa, H.; Kuramoto, C.; Akita, Y.; Takahashi, O. (Kyoto Univ, Yoshida, Sakyo-ku, Jpn). *Int. J. Multiphase Flow;* **3**: No. 5, 445-457(Aug 1977).

Experimental data are presented in this paper on the profiles of local void fraction, bubble impaction rate, bubble velocity and its spectrum, and also bubble length and its spectrum, of mercury-argon two-phase slug flow flowing upwards in a vertical circular tube in the presence of a transverse magnetic field. 9 refs.

**22610** **Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs.** Misra, B.; Youngdahl, C.K.; Stevens, H.C.; Maroni, V.A. (Argonne National Lab., IL). *Trans. Am. Nucl. Soc.;* **27**: 72-73(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22611** **Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system.** Majumdar, S.; Misra, B. (Argonne National Lab., IL). *Trans. Am. Nucl. Soc.;* **27**: 73-74(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22612** **Redundant coolant capability for fusion reactor blankets.** Yu, W.S.; Powell, J.; Fillo, J. (Brookhaven National Lab., Upton, NY). *Trans. Am. Nucl. Soc.;* **27**: 74-77(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## HEATING AND FUELING SYSTEMS

*REFER ALSO TO CITATION(S) 22543, 22602*

**22613** (BNL—23389) **Negative hydrogen ion sources for neutral beam injectors.** Prelec, K. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 5p. (CONF-771029—185). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

Negative ion sources offer an attractive alternative in the design of high energy neutral beam injectors. The requirements call for a single source unit capable of yielding $H^-$ or $D^-$ beam currents of up to 10 A, operating with pulses of 1 s duration or longer, with gas and power efficiencies comparable to or better than achievable with double electron capture systems. $H^-$ beam currents of up to 1 A have already been achieved in pulses of 10 ms; gas and power efficiencies were, however, lower than required. In order to increase the $H^-$ yield, extend the pulse length and improve gas and power efficiencies fundamental processes in the source plasma and on cesium covered electrode surfaces have to be analyzed; these processes will be briefly reviewed and scaling rules established. Based on these considerations as well as on results obtained with 1 A source models a larger model was designed and constructed, having a 7.5 cm long cathode with forced cooling. Results of initial tests will be presented and possible scaling up to 10 A units discussed.

**22614** (BNL—23391) **Acceleration of one ampere negative ion beams to energies up to 120 keV.** Lam, C.; Sluyters, T. (Brookhaven National Lab., Upton, N.Y. (USA)). 1977. Contract EY-76-C-02-0016. 3p. (CONF-771029—186). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

One of the objectives of the BNL Neutral Beam Development Group is to accelerate negative hydrogen ion beams to energies of several hundreds of kilovolts. In a first attempt, negative ions, produced from surface plasma sources, are extracted at around 15 keV and accelerated across a single gap to energies of 120 keV. Beam currents in excess of one ampere have been accelerated.

**22615** (CONF-771029—147) **New ORNL neutral beam transport system.** Stirling, W.L.; Davis, R.C.; Haselton, H.H.; Schnechter, D.E.; Tsai, C.C. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 5p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

The Princeton Large Torus (PLT) neutral beam injection systems have proven themselves to be a solid foundation on which next generation systems can be based. There are two areas in the new systems receiving particular emphasis: (a) increased power per beam line and (b) higher beam transmission efficiency. Two different methods are being investigated to improve the transmission efficiency. First the drift tube region, the region of the beam line between the vacuum chamber housing the ion source and the torus, is being enlarged. In this manner a second, large cryopump will be installed in the drift tube to lower the pressure to $\sim 10^{-5}$ torr. Thus, neutral

beam reionization on the background gas will be significantly reduced from the measured losses at a few $10^{-4}$ torr of the PLT system. Second, the beam divergence will be reduced by application of one or more of three known techniques developed on a single aperture source in the laboratory. Each of these methods has shown a reduction in single beamlet divergence from theta/sub HWHM/ ~ 1° to ~0.5°. The low beamlet divergence coupled with a differentially pumped drift tube will effectively accommodate the larger ion sources under development. All future beam line systems will benefit either directly or indirectly from the experience gained operating and upgrading the PLT beam line concept.

**22616** (CONF-771029—188) **Power and gas flow models for monoenergetic neutral beam injectors.** Fasolo, J.A. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 9p. Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

Large, ignition tokamak reactors (ITR, EPR, and beyond will require supplemental heating to achieve ignition. In the earlier machines, at least, this heating will probably be provided by monoenergetic neutral beams. These beams, with energies approximately greater than 150 keV, will most likely be derived from $D^+$ or $D^-$ ions produced by direct extraction ion sources. A positive ion source will be followed by a bending magnet, a neutralizer, and a second bending magnet. The first magnet will remove molecular ions, and the second one atomic ions. Direct convertors will be used to recover energy from unused molecular and atomic ions. The first bending magnet may be omitted if $D^-$ ion sources are used. Models have been developed for power and gas flow in injectors which employ direct extraction $D^+$ or $D^-$ ion sources. The power flow model accounts explicitly for all beam losses in terms of line densities of gas along paths traversed by ions and neutrals and cross sections for dissociation and charge-changing collisions. The gas flow model uses the results of power flow calculations and known gas flows from sources and neutralizers to determine gas loads and pumping requirements in various parts of the injector.

**22617** (COO—2765-7) **Focussing of an ion beam from a reflex triode.** Kaye, R.J.; Johnson, G.B.; Verdeyen, J.T. (Illinois Univ., Urbana (USA). Gaseous Electronics Lab.). Nov 1977. Contract EY-76-S-02-2765. 15p. Dep. NTIS, PC A02/MF A01.

The method employs the use of electrostatic space charge fields to accelerate, focus, and tailor the arrival times of the ions on a target. Some of the test results are briefly described. (MOW)

**22618** (LBL—6383) **Calorimetric and optical beam diagnostics on the LBL 120-keV neutral beam test facility.** Burrell, C.F.; Cooper, W.S.; Steele, W.F.; Smith, R.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1977. Contract W-7405-ENG-48. 5p. (CONF-771029—176). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

The 120-keV Neutral Beam Test Facility at LBL is fitted with several types of instrumentation to determine the properties of the 10- to 15-A hydrogen and deuterium beams produced in this facility. These include a neutral particle dump for measuring the temperature profile generated by the beam, and a fixed and a moveable ion dump to measure the temperature profiles generated by the various ion components after they have been swept out of the neutral beam by a bending magnet. These several dumps provide enough information to determine the power density profiles and divergences of the neutral beam and the various ion beams for comparison with theoretical calculations, the beam composition, and the neutralization efficiency. The optical beam diagnostic consists of a high-resolution spectrometer coupled with a commercial optical multichannel analyzer. These instruments analyze Doppler-shifted optical radiation from the moving neutral atoms in the beam. Analysis of data so obtained provides the aiming directions and divergences of the various energy components in the neutral beam, as well as the beam composition.

**22619** (LBL—6384) **Performance of a developmental 120-keV, 10-A deuterium (14-A hydrogen) neutral beam system.** Berkner, K.H.; Cooper, W.S.; Ehlers, K.W.; Pyle, R.V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1977. Contract W-7405-ENG-48. 5p. (CONF-771029—175). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

We have recently operated the LBL 120-keV neutral beam test facility on deuterium. This facility consists of a large (170,000 l) vacuum system, a plasma source, a multiple-aperture electrostatic accelerator structure, an ion sweep magnet, ion and neutral beam dumps, and a computer diagnostic and control system. The total length of the beamline is about 8.5m. Operation of this test facility on deuterium has produced beams with an energy of 120 keV, a total (ion plus neutral) beam current of 10 A, and a pulse length of 0.5 sec. The beam profile at the location of the dump is bi-gaussian, with 1/e halfwidths of about 1.28 and 0.42 degrees. Deuterium operation has been very limited because of the high neutron production rate (about $10^{11}$ $sec^{-1}$ when the beam is on) and the lack of radiation shielding around the facility.

**22620** (UCRL—80384) **Engineering problems of future neutral beam injectors.** Fink, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Nov 1977. Contract W-7405-ENG-48. 20p. (CONF-771213—1). Dep. NTIS, PC A02/MF A01.

From Plasma heating development requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

Because there is no limit to the energy or power that can be delivered by a neutral-beam injector, its use will be restricted by either its cost, size, or reliability. Studies show that these factors can be improved by the injector design, and several examples, taken from mirror reactor studies, are given.

**22621** (UCRL—80406) **High energy negative deuterium beams using double charge-exchange or surface production.** Hooper, E.B. Jr.; Anderson, O.A.; Orzechowski, T.; Poulsen, P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Nov 1977. Contract W-7405-ENG-48. 26p. (CONF-771213—7). Dep. NTIS, PC A03/MF A01.

From Plasma heating development requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

Experimental and theoretical research on production of negative ion beams is described. Results from a double charge-exchange experiment include 10 ms pulses of 100 ma of $D^-$ accelerated to 60 kV. Equilibrium fractions of $D^-$ in several metal vapors are presented. Mechanisms and measurements of $D^-$ on surfaces are described, and a scheme is shown for producing high current, high energy beams originating on surfaces.

**22622** (UCRL—80408) **Neutral beam requirements for mirror reactors.** Moir, R.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Dec 1977. Contract W-7405-ENG-48. 25p. (CONF-771213—4). MF A01.

From Plasma heating development requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

Portions of document are illegible.

The neutral beam requirements for mirror reactors as presently envisioned are 200 keV for the Field Reversed Mirror (FRM) and 1200 keV for the Tandem Mirror (TMR). The hybrid version of the Standard Mirror, FRM and TMR require 100 to 120 keV. Due to the energy dependence of atomic processes, negative ions should produce neutrals more efficiently than positive ions above some energy and below this energy, positive ions are probably more efficient. This energy is probably somewhere between 100 and 150 keV for $D^0$, and 150 and 225 for $T^0$. Thus we conclude that hybrid reactors can use $D^+$ ions but all of the fusion reactor designs call for $D^-$ ions to make the neutral beams. Trends in the energy requirements are discussed. The hardening of neutral beams against neutron and gamma radiation is discussed.

**22623** (UCRL—80418) **Neutral beam based on positive ions with direct energy conversion.** Moir, R.W.; Barr, W.L.; Blum, A.S.; Hamilton, G.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Dec 1977. Contract W-7405-ENG-48. 25p. (CONF-771213—2). Dep. NTIS, PC A02/MF A01.

From Plasma heating development requirements workshop; Gaithersburg, MD, USA (5 Dec 1977).

Positive ions can make efficient neutral beams when direct energy conversion is incorporated at energies up to 150 keV for $D^0$, 225 keV for $T^0$ and 300 keV for $^3He^0$. Above these energies the efficiency is low (<50%) and falling rapidly, requiring other means for making neutral beams such as negative ions. The virtues of $^3He^0$ beams as a heater are discussed. The role of direct conversion is discussed and the various conversion concepts and the experimental data base are reviewed. The development problems facing direct conversion are: space charge handling, secondary and primary electron suppression, and the fractional energy ions. The next step in the development of efficient neutral beams based on positive ions is argued to be a developmental beam which integrates an advanced ion source with a neutralizer, cryopump, direct converter, heat removal system, and power conditioning system.

**22624** **Studies of deuterium-fueled Tokamak reactors.** Miley, G.H.; Southworth, F.H.; Gerdin, G.; Choi, C. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). *Nucl. Instrum. Methods;* **144**: No. 1, 9-16(1 Jul 1977).

The importance of using non D-T fusion fuels is briefly reviewed. D-D operation where product $^3He$ and T are burned at the same rate as produced (called 'catalyzed-D') is identified as the only advanced fuel that avoids breeding of fuels and yet potentially offers operation under conditions achievable by present magnetic confinement devices. The conceptual design of a Tokamak reactor using catalyzed-D indicates a relatively large reactor (approximately 12 GW gross output, 12 m radius torus), but this could still be quite attractive due to potential improvements in efficiency, reduced radioactivity inventory, and increased first-wall lifetime. While a

number of uncertainties remain, the feasibility of such a reactor does not appear to be too great an extension beyond D-T reactors. Although a fuel such as p-$^{11}$B could offer further advantages by essentially eliminating neutrons and tritium, suitable methods of confining and burning it require a much larger extrapolation of current experience.

**22625 PLT neutral particle injectors.** Haselton, H.H. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 53-55(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22626 Impurity studies experiment/ORMAK-upgrade neutral beam systems.** Stirling, W.L.; Davis, R.C.; Haselton, H.H.; Schechter, D.E.; Tsai, C.C. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 55-56(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22627 Second-generation design calculations of the field-reversed mirror reactor.** Condit, W.C. (Univ. of California, Livermore). *Trans. Am. Nucl. Soc.;* **27**: 90-91(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22628 Cost of tritium bred in a critical fission reactor.** Price, W.G. Jr. (Princeton Univ., NJ). *Trans. Am. Nucl. Soc.;* **27**: 78-79(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22629 Chemical aspects of controlled thermonuclear synthesis problem. Review.** Myasoedov, N.F.; Popov, V.K. *At. Tekh. Rubezhom;* No. 8, 27-36(Aug 1974). (In Russian).

The following basic problems, which arise in developoment of a thermonuclear reactor, are considered: 1) Preparation of initial fuel, with the tritium needed for reactor operation being obtained from lithium in the blankets of the synthesis reactor where the reaction takes place. 2) Manintaining a constant composition in the primary fuel mixture; a diagram and the properties of the components of the first fuel loop are shown; interaction of the plasma with the surface of the reactor walls is important in operation of the first fuel loop; the possible trapping of volatiles from the $H^+$, $D^+$, and $T^+$ ions of the synthesis zon by metallic surfaces with formation of chemical compounds is considered. The capacily of such metals as titanium, zirconium, niobium, and vanadium to serve as hydrogen getters may be made the basis of a method of removing D-T plasma particles from the reactor. 3) Regeneration of tritium from the blankets, in which metallic lithium, fusion of $Li_2BeF_4$ fluorides, or intermetallic compounds of lithium my be used; methods were considered which were based on the use of tritium diffusion through metallic tubes, multi-stage process of removing tritium with a liquid metal (lithium) getter, direct absorption of tritium from the liquid metal with a solid absorber, e.g. yttrium, a means for separating tritium in combined form; scheme of a process for regeneration of this type is presented. 4) The penetrability constants is indicated. 5) Compatibility of construction materials with the breeding medium and the heat-transfer agent. The information presented may be used in carrying out broad programs of combined studies on the behavior and properties of different materials and mediums under experimental (modelling actual conditions of a thermonuclear reactor.

## TRITIUM PROCESSING, ENVIRONMENT AND SAFETY

**22630** (WFPS-TME—068) **Physics of tritium breeding as a geometric programming problem.** Jedruch, J.; Howland, H.R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Fusion Power Systems Dept.). 30 Sep 1977. 14p. (CONF-771029—187). Dep. NTIS, PC A02/MF A01.

From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).

Tritium breeding in a fusion-fission tokamak reactor is optimized by the technique of geometric programming. The neutronic processes are represented as an objective function found by fitting a generalized quadratic function of the zone widths to the breeding ratio found from planned computational experiments. The results of this technique are examined, and the predicted performance compared to neutronic calculations with the optimized values of the design variables.

**22631** (UCRL-Trans—11297) **Radiation protection around a controlled fusion research facility: the Tokamak of Fontenay-aux-Roses, TFR.** (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Nov 1977. Translation of EUR-CEA-FC—880. 53p. Dep. NTIS, PC A04/MF A01.

This report presents the results of x and neutron dosimetry measurements near the Tokamak of Fontenay-aux-Roses (TFR), a device for magnetic confinement of a hot plasma. The biological shield, consisting of an ordinary concrete wall 30 cm thick, limits the dose to less than $10^{-1}$ mrem per discharge, or approximately 10 mrem per day in the entire personnel area. A calculation model taking account of the actual geometry and x-ray scattering by the walls and ceiling and normalized to the measured doses makes it possible to specify the characteristics of the electron beam, which is at the origin of this radiation. The production of photoneutrons (up to $10^{10}$ neutrons per discharge) and the activation of the vacuum chamber originate from electrons with energy in excess of about 10 MeV, carrying a current of 10 to 1000 amperes.

**22632 Generic PSAR for the TF coil system of tokamak fusion reactors.** Majumdar, D.; Botts, T.; Hsieh, S.Y.; Powell, J.R. (Brookhaven National Lab., Upton, NY). *Trans. Am. Nucl. Soc.;* **27**: 11-13(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22633 Reliability requirements for admissible radiological hazards from fusion reactors.** Sawdye, R.; Sefcik, J.A.; Kazimi, M.S. (Massachusetts Inst. of Tech., Cambridge). *Trans. Am. Nucl. Soc.;* **27**: 65-66(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22634 Neutronic analysis of a laser-fusion-driven actinide waste burner.** Berwald, D.H.; Duderstadt, J.J. (Univ. of Michigan, Ann Arbor). *Trans. Am. Nucl. Soc.;* **27**: 82-83(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22635 Recovery of tritium from solid Li-Al and sintered aluminum product (SAP) blanket materials.** Talbot, J.B.; Wiffen, F.W. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 77-78(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

## INERTIAL CONFINEMENT TECHNOLOGY

*REFER ALSO TO CITATION(S) 22019, 22026, 22421, 22428*

**22636** (COO—2007-92) **NPL-NS: a "Next Step" experiment for inertial confinement fusion.** Boody, F.P.; Kruger, A.W.; Lee, D.; Choi, C.K.; Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1978. Contract EY-76-S-02-2007. 5p. (CONF-780202—3). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

The Nuclear-Pumped Laser "Next Step" (NPL-NS) Experiment is a near term fusion experiment designed to: (1) provide a 1 MJ pellet irradiation test facility and (2) demonstrate the feasibility of the NPL-Feedback-Fusion concept.

**22637** (COO—4251-5) **Efficient third harmonic generation of $CO_2$ laser radiation in liquid CO—$O_2$—$SF_6$ mixtures.** Kildal, H.; Brueck, S.R.J. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 1978. Contract ES-77-S-02-4251. 6p. (CONF-780202—10). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

A tripling efficiency of 2% is reported for the $CO_2$ R(6) line at 9.35 μm. Processes that may potentially limit the conversion efficiency are discussed.

**22638** (LA—7014-MS) **Scaling of reactor cavity wall loads and stresses.** Bohachevsky, I.O. (Los Alamos Scientific Lab., N.Mex. (USA)). Nov 1977. Contract W-7405-ENG-36. 13p. Dep. NTIS, PC A02/MF A01.

Scalings of reactor cavity wall loads and stresses are determined by deriving an analytic expression in terms of relevant parameters for each loading induced in the reactor cavity walls by fuel

pellet microexplosion and by deriving associated expressions relating resulting stresses to shell thicknesses. Also identified are problems that require additional investigations to obtain satisfactory explicit stress estimates for the reactor cavity walls.

**22639** (LBL—6768) **Acceleration systems for heavy-ion beams for inertial confinement fusion.** Faltens, A.; Judd, D.L.; Keefe, D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 3 Oct 1977. Contract W-7405-ENG-48. 10p. (CONF-771035—16). Dep. NTIS, PC A02/MF A01.

From 2. international topical conference; Ithaca, NY, USA (3 Oct 1977).

The requirements for a heavy-ion demonstration experiment to achieve useful electric power generation through inertial confinement fusion are discussed. (MOW)

**22640** (SAND—77-1495C) **Stability of multiple shell ICF capsules.** Toepfer, A.J.; Tiffany, W. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1978. Contract EY-76-C-04-0789. 5p. (CONF-780202—1). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

Criteria for shell thickness and surface finish which limit the growth of the most destructive Rayleigh—Taylor modes in multiple shell ICF capsules are derived. The idealized problem of an infinitely massive piston (outer shell) acting on a thin foil (inner shell) is considered to estimate regimes of buffer density, shell separation, and thickness which are less susceptible to instability during the acceleration phase. (MHR)

**22641** (SAND—77-1592C) **Scintillator-photomultiplier response to a simulated REB generated thermonuclear neutron pulse.** Leeper, R.J.; Chang, J. (Sandia Labs., Albuquerque, N.Mex. (USA)). 1977. Contract EY-76-C-04-0789. 5p. (CONF-780202—4). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

Using a special 3 nsec wide neutron source, the thermonuclear neutron "signature" from a relativistic electron beam imploded target has been established.

**22642** (UCID—17555) **First wall costs of an ion-beam fusion reactor.** Hovingh, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1977. Contract W-7405-ENG-48. 26p. Dep. NTIS, PC A03/MF A01.

This paper parametrically investigates the effects of microexplosion energy on the first wall costs of a 4000 MW/sub t/ ion-beam initiated, inertially confined fusion reactor for several first wall materials. The thermodynamic models and the results for microexplosion energies between 400 and 4000 MJ are presented. A solid stainless steel or a composite isotropic graphite over stainless steel first wall can operate for a year at a cost of 0.6 mills per kWh gross electric power output.

**22643** (UCRL—79535) **Performance of the short-pulse oscillators for Argus and Shiva.** Kuizenga, D.J.; Martin, W.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1977. Contract W-7405-ENG-48. 10p. (CONF-771040—8). Dep. NTIS, PC A02/MF A01.

From Electro-Optical systems conference; Anaheim, CA, USA (25 Oct 1977).

The large Nd:glass laser-fusion systems, such as Argus and Shiva, require short-pulse oscillators that are very reliable and predictable. The requirements go well beyond what can reasonably be expected from a passively mode-locked laser. An actively mode-locked and Q-switched oscillator has now been developed that is extremely reliable and predictable, and satisfies all the requirements for the present Nd:glass laser systems. These systems require pulses that are adjustable from less than 100 ps to more than 1 ns, with less than 5% shot-to-shot variation in pulse energy and pulse width. Single-pulse energy from 100 μJ to 1 mJ is sufficient. In this paper we will describe the principle of operation of this short-pulse oscillator, describe the Argus laser configuration, and the results obtained with this oscillator. We will then indicate further developments for the Shiva oscillator and discuss the performance of this laser.

**22644** (UCRL—79736) **Recent advances in near-term laser-fusion target design.** Mead, W.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Aug 1977. Contract W-7405-ENG-48. 25p. (CONF-770881—1). Dep. NTIS, PC A02/MF A01.

From Gordon research conference/laser interaction with matter; Tilton, NH, USA (8 Aug 1977).

Advances in near-term laser-driven fusion pellet design are described. We report the addition of angle dependent absorption and the introduction of a new formulation of the ponderomotive force. The first application of the Incomplete Cholesky-Conjugate Gradient iterative matrix solution method to the LASNEX radiation diffusion package is discussed. A brief overview of experimental results relevant to target simulation is given. We compare LASNEX calculations with recently published Soviet pellet design calculations. Finally, we discuss optimization of exploding pusher targets at 20 TW.

**22645** (UCRL—79776) **Shiva optical diagnostics.** Rienecker, F.; Kobierecki, M.; Ozarski, R.; Seppala, L.; Manes, K.; Merritt, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Oct 1977. Contract W-7405-ENG-48. 20p. (CONF-771136—14). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

In the laser fusion program at Lawrence Livermore Laboratory, no target experiment is complete unless it is complemented by careful measurements of the laser pulse that irradiates the target. For this purpose, an incident beam diagnostics (IBD) package has been designed for the Shiva laser. The package will furnish data on items such as the total energy and the focusable energy out of the laser chain, and the spatial and temporal energy and power distribution at the target plane. Understanding laser-plasma interactions requires knowledge of the amount of 1.06 μm light energy that is scattered in various directions from the target. The light energy that is scattered toward the beam focusing lens is analyzed by a reflected beam diagnostic (RBD) package containing a calorimeter, a multiple image camera and a TV camera. This paper describes the detailed design and operation of the IBD and RBD packages as tools to align spatial filters and targets, as well as to diagnose the laser beams and target reflectivity.

**22646** (UCRL—79779) **Long pulse microsphere experiments at 3 TW.** Boyle, M.J.; Attwood, D.T.; Brooks, K.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Nov 1977. Contract W-7405-ENG-48. 13p. (CONF-771136—11). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

Previous 1.06 μm laser implosion experiments have explored the parameter space associated with microsphere targets of typically less than 100 psec. Exploding pusher experiments have now been performed using long pulses (100 to 200 psec FWHM), and large diameter (100 to 150 μm) targets on the 3 TW Argus laser facility. Absorption, transport, implosion and neutron and α yield characteristics are discussed and compared with earlier short pulse results. The observed neutron yields are discussed in light of the temporal mismatch between the absorption and implosion time scales imposed by the large diameter, long pulse conditions.

**22647** (UCRL—79784) **Shiva target irradiation facility.** Manes, K.R.; Ahlstrom, H.G.; Coleman, L.W.; Storm, E.K.; Glaze, J.A.; Hurley, C.A.; Rienecker, F.; O'Neal, W.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1977. Contract W-7405-ENG-48. 20p. (CONF-771136—13). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

The first laser/plasma studies performed with the Shiva laser system will be two sided irradiations extending the data obtained by other LLL lasers to higher powers. The twenty approximately 1 TW laser pulses will reach the target simultaneously from above and below in nested pentagonal clusters. The upper and lower clusters of ten beams each are radially polarized so that they strike the target in p-polarization and maximize absorption. This geometry introduces laser system isolation problems which will be briefly discussed. The layout and types of target diagnostics will be described and a brief status report on the facility given.

**22648** (UCRL—79787) **Crystal spectograph for imaging high-density targets.** Slivinsky, V.W.; Leipelt, G.R.; Eckels, J.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1977. Contract W-7405-ENG-48. 13p. (CONF-771136—9). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

Laser fusion targets are being designed to achieve 100 times liquid hydrogen density using the LLL Argus laser. One method proposed for diagnosing the high density is to seed the D,T fuel with Ar gas and measure the spatial extent of the region emitting the Ar x-rays. A crystal spectrograph has been built to image in 1-D the hydrogen like (3.32 keV) and helium like (3.14 keV) Ar x-rays. The spectrograph was calibrated using an 8 μm source of Ag L/sub β/ x-rays (3.15 keV) from an x-ray machine.

**22649** (UCRL—79801) **Energy balance measurements for Shiva.** Glaros, S.S.; Rupert, V.C.; Gunn, S.R.; Phillion, D.W.; Kornblum, H.N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Oct 1977. Contract W-7405-ENG-48. 23p. (CONF-771136—12). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

The Lawrence Livermore Laboratory Shiva laser-target interaction facility is designed for experiments at 20 to 30 terawatts. At this power level there will be larger fluxes of neutrons, x-rays, electrons and ions than have been previously measured. The measurements of energy converted into the various reaction products is crucial both in target design and performance analysis of the actual experiment. The total energy absorbed is measured by a box calorimeter surrounding the target except for beam input holes. This measurement prevents the use of other diagnostics, so for normal operation an energy balance module was designed for location on ports on the Shiva target chamber. This module monitors the energy in scattered light at 10640 A and 5320 A or 7118 A. It also contains a faraday cup and plasma and x-ray calorimeters. The distribution of energy in scattered light, plasma and x-rays will be mapped by 58 such modules.

**22650** (UCRL—80104) **Low aspect ratio double shells for high density and high gain.** Lindl, J.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1977. Contract W-7405-ENG-48. 6p. (CONF-780202—8). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

Double shell targets for use with 0.2-1.0 μ lasers are discussed. With 0.2 μ light, such designs achieve 500-1000 times liquid density at 2 KJ, 10% or more of breakeven at 15 KJ, gains of 10 or more at 200 KJ and a gain of 1000 for lasers of 1 to 10 megajoules.

**22651** (UCRL—80169) **LASNEX code for inertial confinement fusion.** Zimmerman, G.; Kershaw, D.; Bailey, D.; Harte, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Oct 1977. Contract W-7405-ENG-48. 6p. (CONF-780202—9). Dep. NTIS, PC A02/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (7 Feb 1978).

A brief description is presented of the physical processes, models and numerical methods employed in the LASNEX code for calculating inertial confinement fusion.

**22652** (UCRL—80249) **Automatic alignment system for the twenty beam shiva fusion laser.** Bliss, E.S.; Holloway, F.W.; Dryden, E.H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Oct 1977. Contract W-7405-ENG-48. 17p. (CONF-771040—7). Dep. NTIS, PC A02/MF A01.

From Electro-Optical systems conference; Anaheim, CA, USA (25 Oct 1977).

The following are described: oscillator/preamp alignment; chain input pointing; spatial filter pinhole alignment; output pointing, focusing, and centering system; and alignment controls. (MHR)

**22653** (UCRL—80314) **Filtered detector arrays for single pulsed photon measurements above 100 keV.** Tirsell, K.G.; Catron, H.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1977. Contract W-7405-ENG-48. 16p. (CONF-771136—19). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

We discuss the design of filtered detector arrays for single pulsed, 100 keV photon spectral and angular distribution measurements at the Lawrence Livermore Laboratory Argus laser facility.

**22654** (UCRL—80322(Summ.)) **High energy electron spectra from 1.06 μm laser produced plasmas.** Tirsell, K.G.; Catron, H.C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Nov 1977. Contract W-7405-ENG-48. 8p. (CONF-771136—15). Dep. NTIS, PC A02/MF A01.

From Annual American Physical Society meeting; Atlanta, GA, USA (7 Nov 1977).

An electron spectrometer has been modified to measure 1.06 μ laser produced electrons in the 0.2 to 1.0 MeV range and has been used extensively at the LLL Argus laser facility. We observe a strong correlation between laser pulse width and the amplitude of electron spectral emission from imploded D-T filled microspheres.

**22655** (UCRL-Trans—11308) **Power source of pumping system of a Q-switched solid-state laser, based on a multisection inductive storage device.** Azizov, E.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Nov 1977. Translation of IAE—2528. 7p. Dep. NTIS, PC A02/MF A01.

The power source consists of a charge generator, a liquid nitrogen-cooled multisection inductive storage device, a power extraction system incorporating breakers and closers for pulse shaping, a feeder line, and protective circuit closers. (MHR)

**22656 Conversion of laser radiation into x-rays in the subnanosecond region.** Bertotti, B. (Pavia Univ. (Italy). Istituto di Fisica); Garifo, L.; Arecchi, F.T.; Greco, A. *J. Phys., D (London);* **10**: No. 12, 1557-1573(21 Aug 1977).

X-ray radiation from the plasma generated on a solid target by a subnanosecond laser pulse is investigated. The analysis is a semiquantitative one, based upon the energy equation with the relevant microscopic processes taken into account. For the simple case of a rectangular pulse, there are three different phases: a heating transient stage, a stationary regime in which all absorbed radiation is reradiated as soft x-rays and a cooling phase. The conditions to be fulfilled in order that the expansion be neglected are investigated in detail. These analytical estimates are compared with the results of a computer code. In a model where energy propagates from the laser absorption layer into the target by heat conduction, the conversion efficiency at moderate fluxes is drastically reduced by the expansion which sets on before the regime is reached. Moreover the emission is delayed. For large power fluxes, following a recent suggestion by Brueckner (Phys. Rev. Lett.; 36:677 (1976)), an energy transfer by fast (10 to 50 keV) electrons is also considered, which thermalize by collisions in a region larger than the layer directly heated by conduction. This reduces the time lag and yields a good power efficiency. Results are presented for absorbed laser fluxes in the range $10^{13}$ to $10^{17}$ W $cm^{-2}$.

**22657 Advanced fuel nuclear reaction feasibility using laser compression. II.** Castillo, R.; Hora, H.; Kane, E.L.; Lawrence, V.F.; Nicholson-Florence, M.B.; Novak, M.M.; Ray, P.S.; Shepanski, J.R.; Sutherland, R.I.; Tsivinsky, A.I. (New South Wales Univ., Kensington (Australia)). *Nucl. Instrum. Methods;* **144**: No. 1, 27-32(1 Jul 1977).

Several problems are considered in order to study the properties of the nonlinear-force compression of plasmas by lasers used to reach conditions for advanced clean fuel nuclear reactions as well as to distinguish from gas-dynamic compression. The propagation of light in inhomogeneous media is based on a simpler, computationally economic programme. The Goos-Haenchen effect is used for discussions of wave propagation and a laser amplifier without superradiance designed. Corrections for α-reheat are derived and a very short-range relativistic self-focusing discovered with relatively low thresholds. Entropy production and electron-radiation interaction are treated relativistically.

**22658 Advanced fuel nuclear reaction feasibility using laser compression. I.** Hora, H. (New South Wales Univ., Kensington (Australia)). *Nucl. Instrum. Methods;* **144**: No. 1, 17-25(1 Jul 1977).

While the most advanced concept of magnetic field confinement, the tokamak, may never be used for advanced clean fuel reactions as $H^{11}B$ or similar nuclei, because of high loss cyclotron radiation and since usual gasdynamic laser compression would need too high laser energies for these cases, one possible concept besides MIGMA is the utilization of laser plasma compression resulting from the nonlinear forces of laser-plasma interaction. The much higher efficiency of transferring laser energy into kinetic energy of thick moving plasma layers at low losses due to thermalization, arrives at laser energies of mejagoules (or less when reheat is taken into account) for $H^{11}B$ to reach total reaction gains of 80. The possibility of ideally adiabatic compression of the plasma is described and the different origins of nonlinear forces by dielectric swelling or by a new mechanism of short range relativistic self-focusing (Kane and Hora) are explained.

**22659 Laser induced thermonuclear fusion.** Stricker, F. *Chem. Zig.;* **101**: No. 7, 351-357(Jul 1977). (In German).

The advantage of the D-T-fusion is compared with the D-D-process. For the energy-balance in the process of the thermonuclear fusion, important thermodynamic conditions, as the Lawson-criterium, is closely entered. Optical systems, which concentrate the laser-rays upon the target, are sketched. The implosion connected with the thermonuclear fusion is described in detail. Varied laser-types, as the neodyme, the $CO_2$, and the iodine laser are compared. The possibility of applying shorter wave lengths and electron rays is shortly eludicated.

**22660 Laser fusion deployment scenario.** Blink, J.A.; Chin, J.S. (Lawrence Livermore Lab., CA). *Trans. Am. Nucl. Soc.;* **27**: 16-17(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22661 Requirements for commercialization of inertial confinement fusion.** Booth, L.A.; Bohachevsky, I.O. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 15-17(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22662 Economic model of a relativistic electron beam hybrid reactor.** Mitchener, J.L.; Varnado, S.G. (Sandia Labs., Albuquerque, NM). *Trans. Am. Nucl. Soc.;* **27**: 17-19(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22663 Characterization of laser fusion reactor concepts.** Booth, L.A.; Frank, T.G. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 32(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22664 Fluorescence-pumped selenium photolytic gas laser system for a commercial laser fusion power plant.** Monsler, M.J. (Univ. of California, Livermore). *Trans. Am. Nucl. Soc.;* **27**: 32-34(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22665 Conceptual design of a laser fusion power plant.** Maniscalco, J.A.; Meier, W.R.; Monsler, M.J. (Univ. of California, Livermore). *Trans. Am. Nucl. Soc.;* **27**: 34-35(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22666 Laser design considerations for an inertially confined fusion reactor.** Cooper, G.W. (Univ. of Wisconsin, Madison). *Trans. Am. Nucl. Soc.;* **27**: 35-36(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22667 SOLASE, a laser fusion reactor study.** Conn, R.W.; Abdel-Khalik, S.I.; Moses, G.A. (Univ. of Wisconsin, Madison). *Trans. Am. Nucl. Soc.;* **27**: 36-37(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22668 Engineering design aspects for SOLASE.** Abdel-Khalik, S.I.; Conn, R.W.; Moses, G.A.; Cheng, E.T.; Larsen, E.M.; Lovell, E.G.; Maynard, C.W.; Sviatoslavsky, I.N.; Wolfer, W.G. (Univ. of Wisconsin, Madison). *Trans. Am. Nucl. Soc.;* **27**: 37-38(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22669 Laser, optics, and pellet design for SOLASE.** Moses, G.A. Conn, R.W.; Abdel-Khalik, S.I.; Cooper, G.W.; Howard, J.E.; Magelssen, G.R. (Univ. of Wisconsin, Madison). *Trans. Am. Nucl. Soc.;* **27**: 38-39(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22670 PHD-IV, a laser-plasma simulation code.** Moses, G.A.; Magelssen, G.R. (Univ. of Wisconsin, Madison). *Trans. Am. Nucl. Soc.;* **27**: 39-40(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22671 Temperature and displacement transients in inertial confinement fusion first walls.** Hunter, T.O. (Sandia Labs., Albuquerque, NM); Kulcinski, G.L. *Trans. Am. Nucl. Soc.;* **27**: 40(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22672 Use of advanced fuels in pellet implosion reactor engineering.** Woodall, D.M. (Univ. of New Mexico, Albuquerque). *Trans. Am. Nucl. Soc.;* **27**: 63(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22673 Direct nuclear-pumped laser approaching feedback laser fusion needs.** Prelas, M.A.; Anderson, J.H.; Boody, F.P.; Miley, G.H. (Univ. of Illinois, Urbana). *Trans. Am. Nucl. Soc.;* **27**: 63-64(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22674 Scaling of reactor cavity wall loads and stresses.** Bohachevsky, I.O. (Los Alamos Scientific Lab., NM). *Trans. Am. Nucl. Soc.;* **27**: 64-65(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

**22675 Energy partition and neutron spectra from laser fusion reactor targets.** Blink, J.A.; Walker, P.E.; Meldner, H.W. (Univ. of California, Livermore). *Trans. Am. Nucl. Soc.;* **27**: 70-71(1977).
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
See CONF-771109—.

## COMPONENT DEVELOPMENT AND MATERIALS TESTING

*REFER ALSO TO CITATION(S) 21899*

**22676** (CONF-771029—182) **Resistive requirements for the vacuum wall of a Tokamak Fusion Reactor.** Brooks, J.N.; Ehst, D.; Harkness, S.D.; Norem, J.; Stevens, H.; Turner, L. (Argonne National Lab., Ill. (USA)). 1977. Contract W-31-109-ENG-38. 7p. Dep. NTIS, PC A02/MF A01.
From 7. symposium on fusion research project; Knoxville, TN, USA (25 Oct 1977).
The effect of having a conducting vacuum wall, instead of one with a flux breaker, has been analyzed from a multi-disciplinary standpoint. There is a good indication that a conducting wall will be tolerable. The most serious problems seem to be in designing an acceptable initiation-trimming coil system and in designing a vacuum wall that can withstand the pressure and heat loads following a plasma dump. There appear to be several promising design approaches for the vacuum wall that can achieve a fairly high resistance and may satisfy the latter constraints.

**22677** (CONF-771036—6) **Dosimetry needs for the Magnetic Fusion Materials Program.** Heinrich, R.R.; Greenwood, L.R.; Odette, G.R.; Farrar, H. IV; Dierckx, R.; Gold, R. (Argonne National Lab., Ill. (USA)). Oct 1977. Contract W-31-109-ENG-38. 22p. Dep. NTIS, PC A02/MF A01.
From 2. ASTM-EURATOM symposium on reactor dosimetry) dosimetry methods for fuels, cladding and structural materials; Palo Alto, CA, USA (2 Oct 1977).
The significance of neutron dosimetry within the MFE materials program is discussed. Experimental results demonstrating the current MFE dosimetry methodology is presented for facilities such as RTNS-I and Be(d,n) facilities. Brief descriptions of planned facilities for high intensity neutron sources are given and experimental data needs are stressed. The potential use of nuclear emulsion techniques for these facilities is discussed.

**22678** (CONF-771109—84) **Remote servicing considerations for near term tokamak power reactors (TNS). Final summary.** Spampinato, P.T. (Oak Ridge National Lab., Tenn. (USA)). 1977. Contract W-7405-ENG-26. 26p. Dep. NTIS, PC A03/MF A01.
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
Next generation Tokamaks require special consideration for remote servicing. Three major problems are highlighted: (1) movement of heavy components, (2) remote connection/disconnection of joints, and (3) remote cutting, welding, and leak detection. The first problem is assumed to be handled with existing expertise and is not considered. The remaining problems are thought to be minimized by considering two engineering departures from conventional tokamak design; locating the field shaping coils outside of the toroidal coils and enclosing the total device within an evacuated reactor cell. Five topics under this vacuum building concept are discussed: incremental cost, vacuum pumping, tritium containment, activation topology, and first year operations.

**22679** (DP-MS—77-47) **Fission-fragment-induced helium blistering of $^{252}$Cf-exposed surfaces.** McDonnell, W.R. (Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.). 1977. Contract EY-76-C-09-0001. 23p. (CONF-771109—71). Dep. NTIS, PC A02/MF A01.
From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).
Inner surfaces of a Pt-10% Rh capsule exposed at room temperature to alpha particles and fission fragments in a large $^{252}$Cf source showed many small blisters, with elongated configurations in some areas. Formation of the blisters was attributed to the fission-fragment-induced agglomeration of helium implanted by the alpha particles, coupled with a stress relieving transport of lattice atoms displaced by the fission fragments into the blister walls. Lateral and

vertical elongation of the blisters resulted from concentration gradients of implanted helium and displaced atoms along the capsule wall. Although no significant deterioration of the $^{252}Cf$ capsule resulted, the observed blistering could have important consequences for materials applications in other complex radiation environments.

**22680** (HEDL-SA—1252) **Review of neutron and charged particle intercorrelation programs.** Garner, F.A.; Laidler, J.J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1977. Contract EY-76-C-14-2170. 65p. (CONF-760673—3). Dep. NTIS, PC A04/MF A01.

From Workshop on correlation of neutron and charged particle damage; Oak Ridge, TN, USA (8 Jun 1976).

The U.S. LMFBR programs have sponsored a number of intercorrelation experiments which seek to provide a basis for predicting neutron-induced property changes from a large variety of charged particle simulation data. The results of these and other programs are reviewed and lead to the conclusion that simulation experiments are quite valuable in meeting the goal of providing guidance for design of fission or fusion energy generation devices. Numerous examples are given of simulation experiments which have been influenced or dominated by the presence of unrecognized atypical variables. All major U.S. intercorrelation activities have been concerned primarily with void growth experiments to simulate fast reactor conditions. This reflects not only the early program emphasis on this important radiation-induced phenomenon but also the fact that void swelling is the only high fluence property change which leaves a cumulative microstructural record in the small material volumes characteristic of simulation experiments. Based on past experiences, guidance is provided for application of intercorrelation results to environments other than those found in fast breeder reactors, and to property changes other than swelling.

**22681** (HEDL-TME—77-81) **HEDL magnetic fusion energy programs. Progress report, April—June 1977.** Doran, D.G. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). Sep 1977. Contract EY-76-C-14-2170. 51p. Dep. NTIS, PC A03/MF A01.

This report describes progress in four HEDL programs supported by the Energy Research and Development Administration's Division of Magnetic Fusion Energy (DMFE). They are (1) Irradiation Effects Analysis, (2) Mechanical Performance of MFE Materials, (3) Preparation and Presentation of Design Data, and (4) Lithium Spill Studies. (1) Results are given on the simulation of 100 to 1000 eV displacement cascades with the quasi-dynamical computer code ADDES, including some comparisons with the dynamical code COMENT (currently being documented). (2) Results are given of a radiation-induced creep measurement on Type 316 stainless steel at 315 to 540°C using 16 MeV protons. (3) The current status of the Nuclear Systems Materials Handbook (NSMH) is described; 95 new and revised pages for Volumes 1 and 2 were distributed. (4) A lithium hazard literature review has been completed and experimental studies initiated.

**22682** (ORNL—5302) **Evaluation of the fatigue resistance of CDA 182 copper for use in the impurity study experiment fusion research tokamak (ISX).** Corwin, W.R.; Hussung, R.O.; Lousteau, D.C.; Poore, M.W. (Oak Ridge National Lab., Tenn. (USA)). Jan 1978. Contract W-7405-ENG-26. 35p. Dep. NTIS, PC A03/MF A01.

The fatigue behavior of CDA 182, a Cu-1% Cr alloy, was evaluated under load-controlled cycling, simulating service conditions in ISX, a fusion research Tokamak. Heat-treated, work-hardened CDA 182 was selected for use in ISX on the basis of relatively good mechanical strength and high electrical conductivity. In fully reversed and zero-to-maximum-tension uniaxial fatigue tests at room temperature, engineering stress amplitude versus number of cycles to failure and cyclic strain behavior were determined for cyclic lives from $2 \times 10^3$ to $4 \times 10^6$. Cyclic softening and tensile rachetting both occurred during fully reversed cycling, but neither occurred in the zero-to-maximum-tension tests. Varying degrees of nonisotropic deformation were observed under both conditions of loading. Increasing the testing temperature to 66°C (150°F) slightly reduced fatigue strength but did not affect the cyclic strain response. In addition to uniaxial tests, prototype specimens of the "weakest link" in the ISX design for CDA 182, an interlocking finger joint, were tested under load control. These tests assessed the degrading effect of stress concentrations in the joint on the fatigue resistance of the material. The prototypic tests simulated both normal and above-normal loading conditions. Details on the finger joint specimen configuration, test results, and fractographic observations on the failure mode are reported. The combined results of both portions of the test program allowed the fatigue stress concentration factor of the joint to be estimated for a range of cyclic lives bounding the design lifetime of the device. Subsequent analysis indicated that a substantial margin of safety exists for expected conditions of service in ISX.

**22683** (PPPL—1399) **Feasibility of beam driven semi-catalyzed deuterium fusion neutron sources for hybrid reactor applications.** Greenspan, E. (Princeton Univ., N.J. (USA). Plasma Physics Lab.). Dec 1977. Contract EY-76-C-02-3073. 60p. Dep. NTIS, PC A04/MF A01.

The assessment is based on the estimation of the fusion device plasma properties using a simple point model, on general energy balance considerations for hybrid reactors for power generation, and on the estimation of expected performance of a specific type of hybrid reactor-a natural uranium fueled, light water moderated breeding hybrid power reactor driven by a semi-catalyzed deuterium fusion neutron source. Beam-driven semi-catalyzed deuterium and D-T fusion devices for hybrid power reactor applications are compared, and potential advantages of the former are identified. It is found that the plant efficiency of hybrid power reactors driven by a semi-catalyzed deuterium neutron source might exceed that attainable with a D-T neutron source when the fraction of the fusion neutrons that reach the blanket is smaller than about 0.8. A beam-driven deuterium fusion device can be operated in the semi-catalyzed mode and provide an intense source of neutrons even for plasma electron temperatures as low as 5 keV. Such a fusion neutron source might be useful for experimental facilities.

**22684** **Performance of 4.2 K cryopumps in neutral beam injectors.** Schwenterly, S.W.; Dagenhart, W.K.; Haselton, H.H.; Stirling, W.L.; Tsai, C.C. (Oak Ridge National Lab., TN). *Trans. Am. Nucl. Soc.;* **27**: 56-57(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22685** **Thermochemical water-splitting cycle applicable to fusion reactors for production of synthetic fuels.** Steinberg, M.; Dang, V.D. (Brookhaven National Lab., Upton, NY). *Trans. Am. Nucl. Soc.;* **27**: 80-82(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22686** **Remote servicing features of two new mirror fusion reactors.** Neff, W.S. Jr. (Univ. of California, Livermore). *Trans. Am. Nucl. Soc.;* **27**: 66-67(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

**22687** **Considerations of the recycle time for radioactive titanium alloy structures.** Kulcinski, G.L. (Univ. of Wisconsin, Madison); Davis, J.W.; Sung, T.Y. *Trans. Am. Nucl. Soc.;* **27**: 79-80(1977).

From ANS winter meeting; San Francisco, CA, USA (27 Nov 1977).

See CONF-771109—.

# GENERAL AND MISCELLANEOUS

## MANAGEMENT

**22688** (UCID—17613) **Proposal for development of an interactive project management code.** Ames, H.S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Dec 1977. Contract W-7405-ENG-48. 31p. Dep. NTIS, PC A03/MF A01.

The problems of generating, analyzing, updating project schedules, and predicting project costs are discussed. Some of the techniques currently being used for managing projects are discussed. The goals and capabilities of an Interactive Project Management Code (IPMC) are enumerated, and the conceptual design and capabilities of the propsoed IPMC are described. The cost of several alternative implementation schemes are analyzed, and an approach is recommended. 12 figures, 1 table.

## MATHEMATICS AND COMPUTERS

**22689** (CONF-7706104—1) **Design and implementation of a local computer network.** Fortune, P.J.; Lidinsky, W.P.; Zelle, B.R. (Argonne National Lab., Ill. (USA)). 1977. Contract W-7405-ENG-38. 7p. Dep. NTIS, PC A02/MF A01.

From IEEE conference; Chicago, IL, USA (Jun 1977).

An intralaboratory computer communications network was designed and is being implemented at Argonne National Laboratory. Parameters which were considered to be important in the network design are discussed; and the network, including its hardware and

software components, is described. A discussion of the relationship between computer networks and distributed processing systems is also presented. The problems which the network is designed to solve and the consequent network structure represent considerations which are of general interest. 5 figures.

**22690** (COO—2383-45) **Methods for oscillating problems.** Petzold, L.; Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Oct 1977. Contract EY-76-S-02-2383. 36p. (UILU-ENG—77-1752). Dep. NTIS, PC A03/MF A01.

Initial-value problems for ordinary differential equations with highly oscillatory solutions are considered. A solution method, applicable to linear or nonlinear oscillations, is discussed; essentially, the method defines an "envelope" and attempts to compute that. This method steps over many periods at a time. A method for correcting an initial estimate of the period is disclosed. Some theoretical results are proved, and a numerical example is presented. (RWR)

**22691** (LBL—6142) **Dynamic ADI methods for elliptic equations with gradient dependent coefficients.** Doss, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1977. Contract W-7405-ENG-48. 131p. Dep. NTIS, PC A07/MF A01.

Thesis.

The dynamic alternating direction implicit (DADI) methods, previously introduced and applied to elliptic problems with linear and nonlinear coefficients (a(u)), are applied here to elliptic problems with nonlinear gradient-dependent coefficients (a(grad u)), such as the minimal surface equation, the capillary surface equation, and the magnetostatic equation. Certain improvements of these methods are developed, and they are extended to "3-directional" or "3-dimensional" situations. 28 figures, 6 tables.

**22692** (SAND—77-1023) **Starting an ODE solver.** Shampine, L.F. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1977. Contract EY-76-C-04-0789. 31p. Dep. NTIS, PC A03/MF A01.

A scheme is developed for the automatic selection of the initial step size for an ODE solver. Additional devices are developed to increase the reliability and efficiency of the selection for stiff problems. The question of starting the integration with zero initial values when a pure relative error control is desired is answered for some kinds of codes. Some numerical results are given to illustrate the devices and support some of the conclusions.

**22693** (SU—326-P.39-26) **Studies in the organization of computer systems. 1977 progress summary. Technical note No. 121.** Flynn, M.J. (Stanford Univ., Calif. (USA). Digital Systems Lab.). Nov 1977. Contract EY-76-S-03-0326-039. 13p. Dep. NTIS, PC A02/MF A01.

This project studied theoretical and practical methods for the categorization, analysis, and synthesis of computing systems. In particular, an Emulation Laboratory was developed for the analysis of computer architectures and interpretive computer designs. A memory hierarchy management study developed techniques to improve the performance of multilevel virtual memory systems. Efforts in the areas of parallel processors and program representation continued. 1 figure, 1 table.

**22694** (UCRL—52242) **Fitting noisy data with a complex exponential series.** Dudley, D.G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Mar 1977. Contract W-7405-ENG-48. vp. Dep. NTIS, PC A03/MF A01.

The process of fitting noisy data with a complex exponential series is considered. An analysis of the classical Prony method shows that attempts to obtain accurate answers in the presence of noise met with considerable difficulties. Recasting the problem as one of system identification and applying the least-squares method leads to biased estimates of the parameters in the characteristic equation for the system. The difficulty centers around the fact that neither classical Prony nor least squares involves any analysis, identification, smoothing, or filtering of the noise. Some techniques for improving results are discussed, and an iterative generalized least-squares procedure, which leads to a noise filter, is recommended for further study. 1 figure, 1 table.

**22695** **Computer methods for sampling from student's t distribution.** Kinderman, A.J.; Monahan, J.F.; Ramage, J.G. (Department of Management Science, California State University, Northridge, Northridge, California 91330). *Math. Comput.;* **31**: No. 140, 1009-1018(Oct 1977).

Several new algorithms for generating deviates from the t family for the degrees of freedom parameter $>$ or $=1$ are presented. Both acceptance-rejection and probability mixing procedures are developed. The new algorithms outperform traditional methods for generating deviates from the t family. Recommendations are made concerning choosing an algorithm suited to its application.

**22696** (UCRL-Trans—11303) **Almost-periodic Markov processes.** Jacobs, K. Translated from *Math. Ann.;* **134**: 408-427(1958). 34p. Dep. NTIS, PC A03/MF A01.

The asymptotic behavior of finite probability distributions which change in discrete time intervals by way of transition probabilities exteriorly governed in an almost-periodic fashion has been investigated [Abh. Math. Sem. Hamburg, 21, 194-246 (1957)]. It was found that these distributions become conformable, with exponential rapidity, to distributions which vary absolutely almost-periodically. In the present work this result is extended to general Markov processes. In order to treat the temporally discrete case together with the continuous case, a closed additive group of real numbers is presupposed as a time range. (RWR)

## INFORMATION HANDLING

*REFER ALSO TO CITATION(S) 20967, 21679*

**22697** (UCRL—80171) **General features of a scientific data base management system.** Hampel, V.E.; Ries, D.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Sep 1977. Contract W-7405-ENG-48. 28p. (CONF-771062—4). Dep. NTIS, PC A03/MF A01.

From OECD/NEA working group on nuclear information; Berkeley, CA, USA (5 Oct 1977).

Probable causes for the absence of a Generalized Data Base Management System (GDBMS) as a portable program at any one of the ERDA National Laboratories are discussed: difficulty to recognize the value of accurate and up-to-date information and data as a national resource, the gradual evolution of high-efficiency specialized installation-dependent programs where large volumes of data are present, the historical trend to judge the power of a computer by its calculational speed alone, the consequent delegation of data management to a piggy-back parasitic role on the large machines, the difficulty faced by the casual user in learning the peculiarities of a home-grown data management system, and finally the absence of a Public Well of authenticated scientific and technological data that are computer-readable. In view of these considerations over the past two decades, and on the basis of experience with a diversity of simple and complex information and data, some of the necessary and desirable features for a general Scientific Data Base Management System (SDBMS) are established. A prototype is now under development at the Lawrence Livermore Laboratory. A practical approach is explored that is based on the relational technique of data management and the integration of a number of available essential programs into one Integrated Information System. The decrease in hardware costs, the increase in human costs, and the steadily improving communications among National Laboratories and the international community are believed to suggest the extended design of such or a similar system at distributed computer centers. The state of the art in computer science gives confidence in the feasibility of this approach. It is prayed that the new and far-reaching responsibilities of administrators in the Department of Energy may make it possible. 7 figures, 52 references.

# CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

## A


**AAI Corp., Baltimore, Md. (USA)**
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627—2)

**Aerochem Research Labs., Inc., Princeton, N.J. (USA)**
Silicon halide—alkali metal flames as a source of solar grade silicon. First quarterly report, 3:21278 (ERDA/JPL/954777—77/1)

**Air Pollution Systems, Inc., Seattle, Wash. (USA)**
Development program for an ionizer—precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report, 3:20899 (EPRI-FP—291(Vol.1))
Development program for an ionizer—precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:20900 (EPRI-FP—291(Vol.2))

**Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center**
Solar heating and cooling technical data and systems analysis. Progress report, October 1974—30 April 1977, 3:21330 (N—77-26611)

**Alaska State Legislature, Juneau (USA)**
Economic analysis of Alaskan royalty gas contracts. A report to State of Alaska: the legislature, 3:21736 (PB—269528)

**Alaska Univ., Fairbanks (USA). Inst. of Marine Science**
Review of the chemical speciation of copper in seawater, 3:22214 (RLO/2229/T1—41)
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976—May 31, 1977, 3:22286 (RLO/2229/T1—40)

**Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office**
Development of a fluidized-bed calciner and past-treatment processes for solidification of commercial fuel-reprocessing liquid wastes, 3:21170 (ICP—1136)
Technical Division quarterly progess report, July 1—September 30, 1977, 3:21169 (ICP—1132)

**Ames Lab., Iowa (USA)**
Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976—30 September 1977, 3:20879 (IS—4310)
Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April—30 June 1977, 3:20880 (IS—4311)
Aluminum recovery from coal fly ash by high temperature chlorination, 3:20903 (IS-T—777)
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T—778)
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T—741)
Low temperature heat capacity of scandium and alloys of scandium, 3:21882 (IS-T—780)

**AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki**
B-5 proton-ion synchrotron, 3:22100 (UCRL-Trans—1542)

**Argonne National Lab., Ill. (USA)**
Analysis of the high-temperature particulate collection problem, 3:20922 (ANL—77-14)
Angular distributions of photoelectrons and non-thermal photoions from atoms and molecules, 3:22314 (CONF-770935—4)
ANL experimental program for pulsed superconducting coils, 3:22593 (CONF-771029—184)
Biomimetic approach to solar energy conversion, 3:21308 (CONF-770582—1)
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101—3)
Design and implementation of a local computer network, 3:22689 (CONF-7706104—1)
Dosimetry needs for the Magnetic Fusion Materials Program, 3:22677 (CONF-771036—6)
Effects seen in the interactions of fast molecular-ion beams with matter, 3:22311 (CONF-770931—4)
Environmental control technology program studies at Argonne National Laboratory: surface mine effluents, 3:20911 (CONF-7710101—4)
High energy spectroscopy, 3:22341 (FERMILAB-Conf—77/66-THY)
Limits on the field of ohmic heating solenoids, applied to a tokamak TNS, 3:22595 (CONF-771029—199)
Long-term availability of water resources for energy development in the central United States, 3:21740 (CONF-7710101—5)
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024—3)
Neutron induced gamma spectrometry for on-line compositional analysis in coal conversion and fluidized-bed combustion plants, 3:20887 (CONF-771072—3)
Plasma engineering studies for the tokamak experimental power reactor, 3:22535 (CONF-771029—190)
Power and gas flow models for monoenergetic neutral beam injectors, 3:22616 (CONF-771029—188)
Pressurized fluidized-bed combustion combustion test and integration unit, PFBC/CTIU project. ANL monthly progress report, October 1977, 3:20923 (ANL/CTIU/FE—005)
Resistive requirements for the vacuum wall of a Tokamak Fusion Reactor, 3:22676 (CONF-771029—182)
Signal analysis method using cross-correlation of turbulence flow signals to determine calibration of permanent magnet sodium flowmeters, 3:21579 (CONF-771023—23)
Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs, 3:22210 (ANL/ES—61)

Theoretical review of strange and nonstrange mesons, 3:22350 (FERMILAB-Conf—77/65-THY)
Theory of the temperature dependence of positron bulk lifetimes-implications for vacancy formation enthalpy measurements via positron experiments, 3:22317 (CONF-761027—26)
Thermal responses of tokamak reactor first walls during cyclic plasma burns, 3:22577 (CONF-771029—189)
Transition to decentralized energy systems, 3:21739 (CONF-7710101—1)
Uranium nitride: a cubic antiferromagnet with anisotropic critical behavior, 3:21901 (CONF-771080—2)
Vacancy properties in gold, 3:21877 (CONF-761027—25)

**Army Missile Research Development and Engineering Lab., Redstone Arsenal, Ala. (USA). Army High Energy Laser Directorate**
Medium homogeneity in a chemical laser cavity using a lateral shearing interferometer. Technical report, 3:22017 (AD-A—042504)

**Association of Physical Plant Administrators of Universities and Colleges, Washington, D.C. (USA)**
Energy conservation on campus. Volume I. Guidelines, 3:21793 (FEA/D—76/229(Vol.1))

**Atlantic Richfield Hanford Co., Richland, Wash. (USA)**
Hanford groundwater transport estimates for hypothetical radioactive waste incidents, 3:22223 (ARH-LD—162)

**Atomic Energy of Canada Ltd., Chalk River, Ontario**
Uranium nitride: a cubic antiferromagnet with anisotropic critical behavior, 3:21901 (CONF-771080—2)

**Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment**
Sources, availability and cost of future energy, 3:21713 (AECL—5816)

**Atomics International Div., Canoga Park, Calif. (USA)**
Disc-Donut-Tube wear test report, Phase I, 3:21588 (TID—27816)

**Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant**
Quantitative respirator man-testing at Rocky Flats, 3:22010 (RFP—2433)
Radiation monitor training program at Rocky Flats, 3:22281 (RFP—2434)
Summary report of soil removal preliminary excavations. (Report No. ES-389-75-171), 3:21166 (RFP—2458)

**Avco-Everett Research Lab., Inc., Everett, Mass. (USA)**
Development program for MHD power generation. Quarterly report, April 1976—June 1976, 3:21752 (FE—2015-12)
Development program for MHD power generation. Quarterly report, October 1976—December 1976, 3:21753 (FE—2015-21)
Development program for MHD power generation: coal devolatilization. Final report, Volume VI, July 1, 1975—September 30, 1976, 3:20855 (FE—2015-20)

## B

**Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.**
One-Third-Scale Air—Water Pump Program: test program and pump performance, 3:21637 (EPRI-NP—135)
One-Third-Scale Air—Water Pump Program, alternate analytical pump performance data, 3:21638 (EPRI-NP—385(Vol.1))
One-Third-Scale Air—Water Pump Program, LOCA and pump overspeed analyses. Final report, 3:21639 (EPRI-NP—474)

**Battelle Columbus Labs., Ohio (USA)**
Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 1. Draft target and support document, 3:21823 (PB—269869)
Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 2. Appendixes Part 1. Draft target and support document, 3:21824 (PB—269870)
Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 4. Revisions and addenda. Draft target and support document, 3:21826 (PB—269872)
Developing a maximum energy efficiency improvement target for sic 28: chemicals and allied products. Volume 3. Appendixes part 2. Draft target and support document, 3:21825 (PB—269871)
Developing a maximum energy efficiency target for SIC 28: chemicals and allied products. Volume 5. Further revisions. Draft target and support document, 3:21827 (PB—269873)
Developing a maximum energy efficiency target for SIC 28: chemicals and allied products. Volume 6, 3:21828 (PB—269874)
Factors affecting the corporate decision making process of air transport manufacturers. Final report, 3:21801 (N—77-27020)

**Battelle Pacific Northwest Labs., Richland, Wash. (USA)**
Accuracy of wind power estimates, 3:21460 (PNL—2442)
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL—2004-6)
Effect of generalized wind characteristics on annual power estimates from wind turbine generators, 3:21459 (PNL—2436)
Hanford 67-series: a volume of atmospheric field diffusion measurements, 3:22141 (PNL—2433)
Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971—1975, 3:22207 (PNL—2383)
Study of plutonium oxide leak rates from shipping containers. Quarterly progress report, April 1, 1977—June 30, 1977, 3:22013 (BNWL—2260-3)

**Bechtel Corp., San Francisco, Calif. (USA)**
Engineering review and evaluation of Combustion Engineering, Inc., coal gasification process development unit. Final report, 3:20853 (EPRI-AF—558)

**Bendix Corp., Kansas City, Mo. (USA)**
Development of an automated foam processing system. Final report, 3:21910 (BDX—613-1691(Rev.))
Development of plating thickness standards for the physical vapor deposition of aluminum on Kapton, 3:21873 (BDX—613-1634(Rev.))
Digital RLC analysis of CDU fireset x-units, 3:22138 (BDX—613-1945)
Modification of SEC 3000 bonder for electronic flame-off, 3:22077 (BDX—613-1875)

**Bendix Field Engineering Corp., Grand Junction, Colo. (USA)**
Preliminary study of favorability for uranium of the Sangre de Cristo Formation in the Las Vegas basin, northeastern New Mexico, 3:21123 (GJBX—82(77))
Preliminary study of the uranium favorability of granitic and contact-metamorphic rocks of the Owens Valley area, Inyo and Mono Counties, California, and Esmeralda and Mineral Counties, Nevada, 3:21120 (GJBX—3(78))
Preliminary study of the uranium favorability of tertiary rocks, southeastern Oregon: eastern Klamath, Southern Lake, Harney, and western Malheur Counties, 3:21124 (GJBX—92(77))
Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX—78(77))
Preliminary study of uranium favorability of the Wilcox and Claiborne Groups (Eocene) in Texas, 3:21121 (GJBX—7(78))

**Booz, Allen and Hamilton, Inc., Bethesda, Md. (USA). Booz, Allen Applied Research Div.**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE—2343-45)

**Borg-Warner Corp., Los Angeles, Calif. (USA). Byron Jackson Pump Div.**
Standpipe-bubbler pump level control study system design layout (Task A) W.P. 4413. Engineering memorandum No. 0153, 3:21589 (TID—27895)

**Boston Univ., Mass. (USA). Dept. of Chemistry**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889—)
Photochemical conversion of solar energy. Annual report, January 1, 1974—December 31, 1974, 3:21316 (NSF/RANN/SE/AER—72-03597/A03/74/4)

**Brookhaven National Lab., Upton, N.Y. (USA)**
Acceleration of one ampere negative ion beams to energies up to 120 keV, 3:22614 (BNL—23391)
Energetics of the United States of America: an atlas, 3:21677 (BNL—50501-R)
Energy information and analytic system for New York State, 3:21679 (BNL—22677)
Negative hydrogen ion sources for neutral beam injectors, 3:22613 (BNL—23389)
Tables of particle fluxes, 3:22120 (BNL—23493)

**Bureau of Mines, Dallas, Tex. (USA). Div. of Petroleum and Natural Gas**
Liquid hydrocarbon production in the United States, 1946-75 and 1980 projected, highlighting enhanced recovery. Information circular, 3:20958 (PB—269951)

**Bureau of Mines, Pittsburgh, Pa. (USA). Coal Preparation and Analysis Lab.**
Desulfurization of various midwestern coals by flotation, 3:20918 (BM-RI—8262)

**Bureau of Mines, Pittsburgh, Pa. (USA). Eastern Field Operation Center**
Coal recovery from bituminous coal surface mines in the eastern United States: a survey. Information circular, 3:20917 (PB—269914)

## C

**California Univ., Berkeley (USA)**
Molecular beam study of the kinetics of the fluorine—uranium dioxide reaction, 3:21998
**California Univ., Berkeley (USA). Dept. of Physics**
Spatial heterodyne interferometry of VY Canis Majoris, alpha Orionis, alpha Scorpii, and R Leonis at 11 microns, 3:22295 (N—77-27049)
**California Univ., Berkeley (USA). Lawrence Berkeley Lab.**
Acceleration systems for heavy-ion beams for inertial confinement fusion, 3:22639 (LBL—6768)
Calorimetric and optical beam diagnostics on the LBL 120-keV neutral beam test facility, 3:22618 (LBL—6383)
Chemical applications of molecular quantum theory, 3:21947 (LBL—6699)
Computational aspects of Glimm's method, 3:22000 (LBL—7228)
Cultivation on sewage of microalgae harvestable by microstrainers. Progress report, 3:21311 (TID—27702)
Dynamic ADI methods for elliptic equations with gradient dependent coefficients, 3:22691 (LBL—6142)
ERDA Geothermal Component Test Facility (GCTF), East Mesa, Imperial Valley, California. Test operations management plan, 3:21449 (TID—28010)
Geothermal reservoir engineering management program plan (GREMP Plan), 3:21400 (LBL—7000)
Nature and formation of nitrogenous air pollutant emissions from combustion systems, 3:21999 (LBL—6850)
Performance of a developmental 120-keV, 10-A deuterium (14-A hydrogen) neutral beam system, 3:22619 (LBL—6384)
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL—6906)
Raman sidescatter instability in a nonuniform plasma, 3:22506 (LBL—6703)
SCR series switch and impulse crowbar at the Lawrence Berkeley Laboratory for CTR neutral beam source development, 3:22602 (LBL—6382)
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL—6017)
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy, 3:21976 (LBL—6682)
Travels in the new world. Volume III, 3:22403 (PUB—113(Vol.3))
View on techniques of preparation of cell and tissue culture specimens for electron microscopy, 3:22233 (LBL—5638)
**California Univ., Berkeley (USA). Operations Research Center**
Extensions of Kalman recursive estimation theory to retrospective updating and interpolation with applications to instrument calibration, 3:21222 (UCRL—13733-5)
**California Univ., Livermore (USA). Lawrence Livermore Lab.**
Analysis of a proposed tidal power plant in the Gulf of Mexico, 3:21458 (UCID—17677)
Automatic alignment system for the twenty beam shiva fusion laser, 3:22652 (UCRL—80249)
BWR Mark I pressure suppression study: bench mark experiments, 3:21649 (UCID—17661)
BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function, 3:21650 (UCID—17662)
Continuous water monitor for oil-shale retort effluent, 3:21108 (UCID—17682)
Crystal spectograph for imaging high-density targets, 3:22648 (UCRL—79787)
Damage history of Argus, a 4TW Nd-glass system, 3:22026 (UCRL—80419)
Detection and measurement of Post-Rosenbluth convective instability in MFTF with a hybrid $CO_2$ laser—heterodyne diagnostic system, 3:22423 (UCRL—52339)
Diagnostic programs used with McGUS a 3D mirror equilibrium code, 3:22422 (UCID—17650)
Directions for possible upgrades of the Mirror Fusion Test Facility (MFTF), 3:22543 (UCRL—80475)
DT fusion neutron irradiation of LLL Nb—1Zr tensile specimens at 600°C, 3:21895 (UCID—17666)
DT fusion neutron irradiation of LLL niobium, 3:22390 (UCID—17669)
DT fusion neutron irradiation of LLL stainless steel tensile specimens at 450°C, 3:21894 (UCID—17665)
Energy balance measurements for Shiva, 3:22649 (UCRL—79801)
Engineering problems of future neutral beam injectors, 3:22620 (UCRL—80384)
Evaluation of the photochemical production of hydrogen from solar energy, 3:21313 (UCID—17535)
Evaluation of the radionuclide concentrations in soil and plants from the 1975 terrestrial survey of Bikini and Eneu Islands, 3:22201 (UCRL—51879(Pt.3))
Fabrication of cryogenic laser fusion targets, 3:21236 (UCRL—79442)
Filtered detector arrays for single pulsed photon measurements above 100 keV, 3:22653 (UCRL—80314)
First wall costs of an ion-beam fusion reactor, 3:22642 (UCID—17555)
Fitting noisy data with a complex exponential series, 3:22694 (UCRL—52242)
General Chemistry Division quarterly report, July—September 1977, 3:21918 (UCID—15644-77-3)
General features of a scientific data base management system, 3:22697 (UCRL—80171)
Geothermal environmental overview project, 3:21433 (UCID—17632)
High energy electron spectra from 1.06 μm laser produced plasmas, 3:22654 (UCRL—80322(Summ.))
High energy negative deuterium beams using double charge-exchange or surface production, 3:22621 (UCRL—80406)
Laser driven fusion fission hybrids, 3:22539 (UCRL—79653)
LASNEX code for inertial confinement fusion, 3:22651 (UCRL—80169)
LEG System: a general Lagrangian-to-Eulerian hydrodynamic code linkage, 3:22323 (UCID—17680)
Liquid metal requirements for inertial confinement fusion, 3:22608 (UCRL—80424)
Long pulse microsphere experiments at 3 TW, 3:22646 (UCRL—79779)
Low aspect ratio double shells for high density and high gain, 3:22650 (UCRL—80104)
Mirror hybrid (fusion—fission) reactor, 3:22542 (UCRL—80076)
Mirror machine program in the USA, 3:22540 (UCRL—79870)
Modeling complex chemical reactions in flows with turbulent, diffusive mixing, 3:22068 (UCRL—79770)
Neutral beam based on positive ions with direct energy conversion, 3:22623 (UCRL—80418)
Neutral beam requirements for mirror reactors, 3:22622 (UCRL—80408)
Oil shale retorting: Part 2, variation in product oil chemistry during retorting of an oil shale block, 3:21105 (UCRL—52256(Pt.2))
Performance of the short-pulse oscillators for Argus and Shiva, 3:22643 (UCRL—79535)
Pinhole imaging of laser-produced thermonuclear alpha particles, 3:22424 (UCRL—79780)
Problems with rho R measurements: what are the ways out, 3:21237 (UCRL—79772)
Proposal for development of an interactive project management code, 3:22688 (UCID—17613)
Proposal to utilize fusion reactor energy sources for chemical process applications, 3:21248 (UCID—17590)
Quality assurance plan. Site 300 chemistry high explosives facilities, 3:22132 (M—078-02)
Reassessment of the requirements to obtain field reversal in mirror machines, 3:22596 (UCID—17691)
Recent advances in near-term laser-fusion target design, 3:22644 (UCRL—79736)
Review of photo-pumped short wavelength lasers, 3:22024 (UCID—17629)
Shiva optical diagnostics, 3:22645 (UCRL—79776)
Shiva target irradiation facility, 3:22647 (UCRL—79784)
Sub-keV, subnanosecond measurements of x-ray spectra from laser-produced plasmas, 3:22425 (UCRL—79782)

Tandem mirror reactor, 3:22541 (UCRL—80075)
Utilization of flywheels for the evolution of high-performance electric vehicles, 3:21857 (UCRL—52346)
**California Univ., Los Angeles (USA). Dept. of Chemical, Nuclear, and Thermal Engineering**
Suppression pool dynamics. Quarterly progress report, April 1—June 30, 1977, 3:21642 (NUREG—0264-4)
**California Univ., Riverside (USA). Statewide Air Pollution Research Center**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL—13782)
**Cameron Engineers, Inc., Denver, Colo. (USA)**
Evaluation of background data relating to new source performance standards for Lurgi gasification. Final report September 1976—February 1977, 3:20861 (PB—269557)
**CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee**
Radiation protection around a controlled fusion research facility: the Tokamak of Fontenay-aux-Roses, TFR, 3:22631 (UCRL-Trans—11297)
**Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Dept. of Hydraulics**
Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps, 3:22015 (STU—75-5234)
**Cincinnati Univ., Ohio (USA). Dept. of Biological Sciences**
Endangered and threatened plant species of the Nevada Test Site, Ash Meadows, and central-southern Nevada, 3:22198 (COO—2307-13)
**City of Long Beach, Calif. (USA)**
Improved secondary oil recovery by controlled water flooding-pilot demonstration Ranger Zone, Fault Block VII, Wilmington Field. Phase I. Quarterly report, July—September 1977, 3:20959 (SAN/1396—12)
**Colorado Univ., Denver (USA). School of Medicine**
Inhalation of dust contaminated with plutonium: Possible health effects. Health considerations of proposed residential development of land contaminated with plutonium in the Denver area, 3:21210 (HRP—0006798)
**Columbia Gas Transmission Corp., Charleston, W.Va. (USA)**
Tertiary oil recovery by $CO_2$ injection, 3:20955 (ORO—5302-16)
Tertiary oil recovery by $CO_2$ injection. Quarterly report, April—June 1977, 3:20956 (ORO—5303-15)
**Columbia Univ., Palisades, N.Y. (USA). Lamont-Doherty Geological Observatory**
Suspended particulates and natural radionuclides as tracers of pollutant transports in Continental Shelf waters of the Eastern U.S.A., 3:22215 (TID—22790)
**Combustion Engineering, Inc., Windsor, Conn. (USA)**
Safety-related research and development for C-E pressurized water reactors. 1976 program summaries, 3:21634 (CENPD—258)
**Combustion Power Co., Inc., Menlo Park, Calif. (USA)**
Granular bed filter development program: particle sampling facility operation, 3:20902 (FE—2579-10)
**Compagnie Generale de Geophysique, Massy (France)**
Does temperature affect electric resistivity of rocks in the Larderello region, 3:21404 (NP—22319)
**Consolidated Controls Corp., El Segundo, Calif. (USA)**
Coal gasification valves, Phase II. Quarterly technical progress report, June 1977—August 1977, 3:20856 (FE—2355-2(Rev.D))
**Control Data Corp., Knoxville, Tenn. (USA)**
National Waste Terminal Storage Program: configuration management plan. Volume II. Plan description, 3:21186 (Y/OWI/SUB—77/16535/4)
National Waste Terminal Storage Program: critical element management concept. Volume I. Management summary, 3:21187 (Y/OWI/SUB—77/16535/7)
National Waste Terminal Storage Program: critical element management concept. Volume II. Concept description, 3:21188 (Y/OWI/SUB—77/16535/8)
National Waste Terminal Storage Program: planning and control plan. Volume II. Plan description, 3:21185 (Y/OWI/SUB—77/16535/2)
**Corning Glass Works, N.Y. (USA)**
Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975—August 31, 1975, 3:21367 (COO/2608—1)
**Council for Educational Development and Research, Washington, D.C. (USA)**
Education confronts the energy dilemma, 3:21678 (CONF-7706101—)
**Curtiss-Wright Corp., Wood-Ridge, N.J. (USA)**
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine, 3:21854 (N—77-26134)

## D

**Denver Research Inst., Colo. (USA)**
Information and data flows in societal problem areas: focus—energy. Final report, 3:21683 (PB—269497)
**Department of Agriculture, Washington, D.C. (USA)**
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables, 3:21749 (FEA/D—77/140)
**Department of Energy, Bartlesville, Okla. (USA). Bartlesville Energy Research Center**
Electrodril System Field Test Program, interim phase. Final report, January—April 1977, 3:20950 (BERC/TPR—77/11)
Heavy oil recovery using solvents and explosives, 3:20949 (BERC/RI—77/16)
Investigative study of engine limiting, 3:21860 (BERC/RI—77/13)
$NO_2$ levels in diesel exhaust, 3:22090 (BERC/TPR—78/1)
**Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Development Sector**
Uranium supply to 2000, Canada and the world, 3:21164 (MR—168)
**Department of Energy, Morgantown, W.Va. (USA). Morgantown Energy Research Center**
Organic composition of Devonian Shale from Perry County, Kentucky, 3:21102 (MERC/TPR—77/3)
**Department of Energy, New York (USA). Environmental Measurements Lab.**
Appendix to Environmental Measurements Laboratory environmental quarterly, 3:22205 (EML—334(App.))
Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977, 3:22152 (EML—334)
**Department of Energy, Pittsburgh, Pa. (USA). Pittsburgh Energy Research Center**
Treatability studies of condensate water from Synthane coal gasification, 3:20904 (PERC/RI—77/13)
**Department of Energy, Washington, D.C. (USA)**
1985 air pollution emissions, 3:22144 (DOE/PE—0001)
**Department of Energy, Washington, D.C. (USA). Div. of Environmental Control Technology**
Environmental control technology activities of the Department of Energy in FY 1977, 3:22230 (DOE/EV—0030)
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV—0004)
**Department of Energy, Washington, D.C. (USA). Div. of Magnetic Fusion Energy**
Perspectives on the development of fusion power by magnetic confinement, 1977, 3:22538 (DOE/ET—0002)
**Department of Energy, Washington, D.C. (USA). Div. of Reactor Research and Development**
Compendium of computer codes for the safety analysis of fast breeder reactors, 3:21636 (DOE/ET—0009)
**Department of Energy, Washington, D.C. (USA). Economic Regulatory Administration**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA—0031)
**Department of Health, Education, and Welfare, Washington, D.C. (USA). Office of Facilities Engineering and Property Management**
State of the art for integrated Energy/Utility Systems, 3:21849 (PB—269684)
**Department of Science and Tech., New Delhi (India)**
Hydrogen Energy Task Force report of the workshop on hydrogen energy, July 13—14, 1977, 3:21242 (NP—22816)
**Department of the Army, Washington, D.C. (USA)**
High power pulse compression techniques, 3:22606
High voltage particle accelerator utilizing polycrystalline ferroelectric ceramic material, 3:22102
**Development Planning and Research Associates, Manhattan, Kans. (USA)**
Energy efficiency improvement targets. Food and kindred products industry (SIC 20). Volume 1. Draft target support document, 3:21820 (PB—269830)
Energy efficiency improvement targets. Food and kindred products industry (SIC 20). Volume 3. Appendix report. Part 2, 3:21822 (PB—269832)

Energy efficiency improvement targets. food and kindred products industry (SIC 20). Volume 2. Appendix report. Part 1, 3:21821 (PB—269831)

**Dienst Grondwaterverkenning TNO, Delft (Netherlands)**
Geophysical well logging for geohydrological purposes in unconsolidated formations, 3:22282 (N—77-26598)

**Donovan, Hamester and Rattien, Inc., Washington, D.C. (USA)**
Federal role in dry and wet-dry cooling tower research, development, and demonstration, 3:21472 (COO/4188—2)

**Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.)**
Sludge from paper production. Final report. Recycling of industrial wastes. Phase II, 3:21840 (BMFT-FB-T—77-08)

**Dow Chemical Co., Midland, Mich. (USA)**
Macro-encapsulation of heat storage phase-change materials for use in residential buildings. First quarterly progress report, September 29—December 29, 1976, 3:21672 (ORO/5217—1)

**Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.**
Field manual for stream water and sediment reconnaissance, 3:21119 (DPST—77-363)
Fission-fragment-induced helium blistering of $^{252}$Cf-exposed surfaces, 3:22679 (DP-MS—77-47)
Low-pressure hydraulic technique for slurrying radioactive sludges in waste tanks, 3:21165 (DP—1468)
Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP—1476)
Pulsed reactivity measurements of large $^{235}$U—Al castings in $H_3O$, 3:22011 (DP-MS—77-49)
Savannah River Laboratory Hydrogeochemical and Stream Sediment Reconnaissance. Preliminary raw data release: Spartanburg 1° x 2° NTMS area, North Carolina and South Carolina. National Uranium Resource Evaluation Program, 3:21118 (DPST—77-146-2)

## E

**Earth Resource Associates, Inc., Athens, Ga. (USA)**
Supplemental field and literature investigation of the upper cretaceous Austin Group (chalk) of Texas with regard to its potential for radioactive-waste isolation, 3:21191 (Y/OWI/SUB—4310/4)

**Ebon Research Systems, Silver Spring, Md. (USA)**
Single cell protein and other food recovery technologies from waste. Final report March—September 1976, 3:21841 (PB—270085)

**Ecole Polytechnique Federale, Lausanne (Switzerland)**
Capturing solar energy in frontages, 3:21332 (NP—22447)

**EG and G Idaho, Inc., Idaho Falls (USA)**
Experiment data report for semiscale Mod-1 test S-06-4 (LOFT counterpart test), 3:21645 (TREE-NUREG—1124)
Experiment data report for semiscale Mod-1 test S-28-4 (steam generator tube rupture test), 3:21647 (TREE-NUREG—1151)
Impedance calculations for power cables to primary coolant pump motors, 3:21562 (LTR—1310-17)
Nuclear structure studies utilizing LAMPF. Annual progress report, 3:22361 (TREE—1115)
Postirradiation examination results for the Irradiation Effects Test Series IE-ST-2, Rod IE-002, 3:21563 (TREE-NUREG—1177)
Posttest REALP4 analysis of LOFT experiment L1-3A, 3:21646 (TREE-NUREG—1137)
Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, July—September 1977, 3:21648 (TREE-NUREG—1188)

**Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Hochenergiephysik**
Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions, 3:22332 (LA-tr—77-76)

**Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik**
Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering, 3:22338 (LA-tr—77-74)

**Energy Research and Development Administration, Albuquerque, N.Mex. (USA). Albuquerque Operations Office**
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design, 3:21323 (ALO/3987—1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix, 3:21324 (ALO/3987—1/3)

**Energy Research and Development Administration, New York (USA). Health and Safety Lab.**
Radon workshop, February 1977, 3:22163 (HASL—325)

**Energy Research and Development Administration, Washington, D.C. (USA)**
Alternative Fuels Demonstration Program. Final environmental impact statement, 3:20912 (ERDA—1547(Vol.2))
Joint ERDA-NRC task force on safeguards. Final report, July 12, 1976, 3:21218 (ERDA—77-34)
Leak detection system design and operating considerations for the US-CRBRP, 3:21578 (CONF-760735—1)
Legal and institutional impediments to geothermal energy resource development: a bibliography, 3:21413 (TID—3365)

**Energy Research and Development Administration, Washington, D.C. (USA). Div. of Physical Research**
Fossil energy research meeting, 3:20841 (CONF-7706100—)

**Energy Research and Development Administration, Washington, D.C. (USA). Div. of Solar Energy**
Fuels from biomass program: thermochemical coordination meeting, 3:21302 (CONF-770235—)

**Energy Research and Development Administration, Washington, D.C. (USA). Office of Fossil Energy**
Coal fired combined cycle for electric power generation, 3:21482 (TID—27939)

**Ente Nazionale per l'Energia Elettrica, Pisa (Italy). Centro di Ricerca Geotermica**
Does temperature affect electric resistivity of rocks in the Larderello region, 3:21404 (NP—22319)

**Environmental Impact Center, Inc., Newton, Mass. (USA)**
Uncertainties in estimates of fleet average fuel economy: a statistical evaluation. Final report November 1975—November 1976, 3:21804 (PB—270025)

**Environmental Protection Agency, Chicago, Ill. (USA). Region V**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB—269902)

**Environmental Protection Agency, Dallas, Tex. (USA). Region VI**
Bush Dome model computing movement of injected crude helium. General instruction manual for computer program KWDX-577-mp for computing gas movement in a gas storage reservoir. Final report, 3:21691 (PB—269451)

**Environmental Protection Agency, Research Triangle Park, N.C. (USA). Environmental Sciences Research Lab.**
Effect of selected parameters on predictions of a photochemical model, 3:21988 (PB—269858)

**Equity Oil Co., Salt Lake City, Utah (USA)**
BX in situ oil shale project. Quarterly progress report No. 1, March 1—May 31, 1977, 3:21104 (TID—27970)

**European Organization for Nuclear Research, Geneva (Switzerland)**
Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr—77-75)
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr—77-67)

**Exxon Nuclear Co., Inc., Richland, Wash. (USA)**
Design features of the ELMO Bumpy Torus Reactor (EBTR), 3:22537 (CONF-771109—65)

## F

**Faucett (Jack) Associates, Inc., Chevy Chase, Md. (USA)**
State-of-the-art of functional use data measuring energy consumption in the commercial sector. Final report, 3:21797 (PB—269906)

**Federal Energy Administration, Washington, D.C. (USA)**
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables, 3:21749 (FEA/D—77/140)
Findings and views concerning the exemption of motor gasoline from the mandatory petroleum allocation and price regulations. Final report, 3:21035 (TID—28102)
Impacts of the western drought on the regional electricity situation, 3:21743 (TID—28064)

Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB—268850)
**Federal Power Commission, Washington, D.C. (USA)**
Impacts of the western drought on the regional electricity situation, 3:21743 (TID—28064)
**Federal Power Commission, Washington, D.C. (USA). Bureau of Power**
Electric utilities captive coal operations, 3:21741 (PB—269348)
Planning status report: water resource appraisals for hydroelectric licensing, 3:21263 (TID—28068)
Status of coal supply contracts for new electric generating units, 1976—1985, 3:21727 (TID—28066)
**Fermi National Accelerator Lab., Batavia, Ill. (USA)**
High energy spectroscopy, 3:22341 (FERMILAB-Conf—77/66-THY)
Theoretical review of strange and nonstrange mesons, 3:22350 (FERMILAB-Conf—77/65-THY)
**Florida State Univ., Tallahassee (USA). Dept. of Chemistry**
Studies of the hydrogen bonded structures of water and methanol, 3:21948 (ORO—1797-76)
**Ford, Bacon and Davis, Inc., New York (USA)**
Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 1. Draft target support document, 3:21817 (PB—269819)
Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 2. Appendix to draft target support document, 3:21818 (PB—269820)
Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 3. Final target support document, 3:21819 (PB—269821)
**Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT—18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT—18S)
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT—20)
Summary of the Phase II, Title I, engineering assessment of inactive uranium mill tailings, Gunnison Site, Gunnison, Colorado, 3:21201 (GJT—125)
**Ford Motor Co., Dearborn, Mich. (USA)**
Stirling engine feasibility study of an 80 to 100 hp engine and of improvement potential for emissions and fuel economy. Final report, 3:21855 (COO—2631-22)
**Foster Associates, Inc., Washington, D.C. (USA). Energy Div.**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB—269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB—269366)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS, 3:21815 (PB—269367)
**Foster-Miller Associates, Inc., Waltham, Mass. (USA)**
Emplacement hole drill evaluation and specification study. Volume II. Appendices, 3:22016 (Y/OWI/SUB—77-22324(Vol.2)(App.))
**Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (Germany, F.R.). Inst. fuer Atmosphaerische Umweltforschung**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974—31 July 1975, 3:22191 (NYO—3425-14)

## G

**Gas Processors Association, Tulsa, Okla. (USA)**
Proceedings of the fifty-sixth annual convention of the Gas Processors Association, 3:21060 (CONF-770375—)
**GCA Corp., Bedford, Mass. (USA). GCA Technology Div.**
Preliminary environmental assessment of coal-fired fluidized-bed combustion systems. Preliminary report September 1975—June 1976, 3:20929 (PB—269556)
**General Accounting Office, Washington, D.C. (USA). Community and Economic Development Div.**
Energy conservation competes with regulatory objectives for truckers: Interstate Commerce Commission. Report to the Congress, 3:21803 (PB—269746)
Environmental protection issues facing the nation, 3:21688 (PB—269748)
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress, 3:21692 (PB—269803)
**General Accounting Office, Washington, D.C. (USA). Energy and Minerals Div.**
Cleaning up the remains of nuclear facilities--a multibillion dollar problem: Energy Research and Development Administration. Nuclear Regulatory Commission. Report to the Congress, 3:21701 (PB—269745)
Outer Continental Shelf Sale 40: inadequate data used to select and evaluate lands to lease. Department of the Interior. Report to the Congress, 3:21729 (PB—269865)
Power production at Federal dams could be increased by modernizing turbines and generators, 3:21266 (PB—269254)
Problems in planning and constructing transmission lines which interconnect utilities: Federal Power Commission, 3:21748 (PB—269614)
**General Accounting Office, Washington, D.C. (USA). Health Resources Div.**
Program to pay black lung benefits to coal miners and their survivors: improvements are needed. Departments of Labor and Health, Education, and Welfare, 3:21689 (PB—269875)
**General Atomic Co., San Diego, Calif. (USA)**
Behavior of fission product gases in HTGR fuel material, 3:21572 (GA-A—13723)
Evaluation of BISO and TRISO coated $ThO_2$ fuel particles irradiated in HFIR capsules HT-12 through HT-15 and HT-17 through HT-19, 3:21571 (GA-A—13557)
Gas-Cooled Fast Breeder Reactor. Quarterly progress report, August 1, 1977—October 31, 1977, 3:21584 (GA-A—14613)
Low-enrichment and mid-enrichment denatured (thorium) fuels for the HTGR: a feasibility study. Final report, 3:21573 (GA-A—14684)
Preliminary maintainability analysis of the HTGR dry head-end reprocessing systems, 3:21151 (GA-A—14678)
Static test of the gas-cooled fast breeder reactor core support grid plate: comparison of experimental, analytical, and finite-element models, 3:21583 (GA-A—14121)
**General Electric Co., Cincinnati, Ohio (USA). Aircraft Engine Group**
Boron/aluminum fan blades for scar engines. Final report, 3:21907 (N—77-26135)
**General Electric Co., Philadelphia, Pa. (USA). Space Div.**
Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10, 3:21360 (SAN/1220—1)
**General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.**
Lattice physics methods. Licensing topical report, 3:21557 (NEDO—20913A)
**General Electric Co., Schenectady, N.Y. (USA)**
Coal fired combined cycle for electric power generation, 3:21482 (TID—27939)
Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report, 3:21475 (N—77-26631)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report, 3:21477 (N—77-26633)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. Part 3: open cycle gas turbines and open cycle MHD. Final report, 3:21478 (N—77-26634)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems: conceptual designs. Part 4: summary of results. Final report, 3:21479 (N—77-26635)
Energy conversion alternatives study (ECAS), phase 2. Volume 3: research and development plans and implementation assessment. Final report, 3:21480 (N—77-26636)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report, 3:21476 (N—77-26632)
**General Electric Co., Sunnyvale, Calif. (USA)**
Leak detection system design and operating considerations for the US-CRBRP, 3:21578 (CONF-760735—1)
**General Instrument Corp., Hicksville, N.Y. (USA)**
Vacancy properties in gold, 3:21877 (CONF-761027—25)

**Geological Survey, Washington, D.C. (USA)**
Subsurface geology of a potential waste emplacement site, Salt Valley Anticline, Grand County, Utah, 3:21183 (USGS-OFR—77-761)
**Georgia Public Service Commission, Atlanta (USA)**
Utility rules of the Georgia Public Service Commission, effective January 1, 1976, 3:21848 (PB—269420)
**Georgia Univ., Athens (USA). Dept. of Physics**
High energy hadron—hadron collisions. Annual progress report, 3:22348 (SRO—946-1)
**Ghana Univ., Legon. Dept. of Physics**
Study of the equatorial ionosphere. Interim scientific report No. 3, 1 January 1974—30 September 1976, 3:22307 (AD-A—042548)
**Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii**
Design and physical principles of the finger-ring T-12 Tokamak with two axisymmetrical diverters, 3:22555 (ORNL-tr—4530)
Energy principle and the kink instability in a toroidal plasma with a strong magnetic field, 3:22488 (ORNL-tr—4410)
Method of studying the spectral composition of powerful high-energy deuteron beams formed in a plasma focus, 3:22451 (UCRL-Trans—11307)
Power source of pumping system of a Q-switched solid-state laser, based on a multisection inductive storage device, 3:22655 (UCRL-Trans—11308)
**Great Lakes Basin Commission, Ann Arbor, Mich. (USA)**
Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report, 3:21684 (PB—271104)
**Grumman Aerospace Corp., Bethpage, N.Y. (USA)**
Helium distribution system for the Large Coil Test Facility (LCTF), 3:22594 (CONF-771029—193)
**Gruy Federal, Inc., Arlington, Va. (USA)**
Pricing effects on frontier oil production. Final report, 3:21728 (PB—269807)

## H

**Hanford Engineering Development Lab., Richland, Wash. (USA)**
HEDL magnetic fusion energy programs. Progress report, April—June 1977, 3:22681 (HEDL-TME—77-81)
Review of microscopic integral cross section data in fundamental reactor dosimetry benchmark neutron fields, 3:22378 (HEDL-SA—1148(Rev.1))
Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA—1252)
Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME—77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME—77-38)
**Hawaii Univ., Honolulu (USA). James K.K. Look Lab. of Oceanographic Engineering**
OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available, 3:21327 (SAN—235P13-39(Vol.1))
**Honeywell Corporate Material Sciences Center, Bloomington, Minn. (USA)**
Silicon on ceramic process. Silicon sheet growth development for the Large-Area Silicon Sheet Task of the Low-Cost Silicon Solar Array Project. Annual report No. 2, September 17, 1976—September 19, 1977, 3:21273 (ERDA/JPL/954356—77/3)
**Hudson Inst., Inc., Croton-on-Hudson, N.Y. (USA)**
100,000 quads of natural gas, 3:21061 (HI—2451/3-P)
Suggestions for a Phase-II national energy policy. Final report, March 1977—September 1977, 3:21723 (FE/2660—1)
**Hughes Aircraft Co., Culver City, Calif. (USA)**
Laser pump development. Final report, 3:22025 (UCRL—13762)

## I

**Idaho National Engineering Lab., Idaho Falls (USA)**
Procedures: Source Term Measurement Program, 3:21623 (NUREG—0384)
**Illinois Univ., Urbana (USA). Dept. of Computer Science**
Methods for oscillating problems, 3:22690 (COO—2383-45)
**Illinois Univ., Urbana (USA). Fusion Studies Lab.**
NPL-NS: a "Next Step" experiment for inertial confinement fusion, 3:22636 (COO—2007-92)
**Illinois Univ., Urbana (USA). Gaseous Electronics Lab.**
Focussing of an ion beam from a reflex triode, 3:22617 (COO—2765-7)
**Institute of Gas Technology, Chicago, Ill. (USA)**
Development of the steam-iron process for hydrogen production. Project 9010 monthly status report, September 1—30, 1977, 3:21253 (FE—2435-19)
Development of the steam—iron system for production of hydrogen for the HYGAS process. Project 8920 final status report, May 1, 1973—June 30, 1976, 3:21252 (FE—1518-46)
Feasibility study of transporting offshore OTEC-produced energy to shore by thermal media. Project 8980 third topical report, November 1976—July 1977, 3:21326 (DSE/2426—19)
Petrographic method for selective determination of a component (raw coal) in a mixture of products from processing of coal, 3:20850 (CONF-780305—1)
Riser cracking of coal to oil and gas, 3:20875 (CONF-770814—10)
**Institut Franco-Allemand de Recherches de Saint-Louis, 68 (France)**
Experimental determination of the contrast of two interfering argon laser beams, 3:22022 (N—77-26490)
**Instituto Nacional de Ciencia y Tecnica Hidricas, Buenos Aires (Argentina)**
Argentine hydrothermal panorama, 3:21394 (CONF-761219—)
Where is Argentina going in geothermal energy, 3:21395 (NP—22124)
XII International Congress of Hydrothermal Techniques. Abstracts of papers presented, 3:21385 (CONF-761219—(Absts.))
**InterGroup Consulting Economists Ltd., Winnipeg, Manitoba (Canada)**
Economic pre-feasibility study: large-scale methanol fuel production from surplus Canadian forest biomass. Part 2. Working papers, 3:21310 (NP—22159/2)
**Intermagnetics General Corp., Guilderland, N.Y. (USA)**
Fast ramp superconductor for ohmic heating coils, 3:22592 (CONF-771029—180)
**Iroquois Research Inst., Fairfax, Va. (USA)**
Archaeological and historical investigations for energy facilities: a state of the art report, 3:21685 (TID—28070)

## J

**Jackson Lab., Bar Harbor, Maine (USA)**
Improved mutagen-testing systems in mice. Progress report, 1 June 1976—31 August 1977, 3:22238 (COO—3267-15)
**Jacoby and Co., Dalton, Pa. (USA)**
Scoping report on various salt mines in the United States, 3:21184 (Y/OWI/SUB—77/16523/2)
**Jet Propulsion Lab., Pasadena, Calif. (USA)**
Coal pump development and technical support. Quarterly project report. Report No. 2, 3:20852 (DOE/JPL/2616—2)

## K

**Kaman Sciences Corp., Colorado Springs, Colo. (USA)**
Safety analysis of an HTGR plant including emergency shutdown. Appendix, Volume 2. Final report, 3:21659 (K—76-124U(R)(Vol.2))
**Kansas Univ., Lawrence (USA)**
Stereoelectronic properties of aggregate chlorophyll systems. Progress report, January 1—December 31, 1977, 3:21975 (COO—2837-3)
**Karlsruhe Univ. (TH) (Germany, F.R.). Fakultaet fuer Maschinenbau**
Possibilities of early detection of failures in steam turbines by evaluating the temperature transmitting behavior of component groups and its correlation with defective variations, 3:21486 (NP—22768)
**Karlsruhe Univ. (TH) (Germany, F.R.). Inst. fuer Experimentelle Kernphysik**
Proposal for an experiment at SIN: dosimetry of the $\pi$E3 beam: determination of the beam components, 3:22111 (LA-tr—77-70)

**Kearney (A.T.), Inc., Chicago, Ill. (USA)**
Energy efficiency improvement target transportation equipment industry (SIC 37). Volume 1, 3:21798 (PB—270068)
Energy efficiency improvement targets for the transportation equipment industry (SIC 37). Volume 2. Industrial programs, conservation and environment. Target support document, 3:21799 (PB—270069)
Energy efficiency improvement targets for the transportation equipment industry(SIC 37). Volume 3. Final target document, 3:21800 (PB—270070)
Energy efficiency improvement targets in machinery (except electrical) industry, SIC 35. Volume 3. Final target document, 3:21831 (PB—269889)
Energy efficiency improvement targets in the machinery (except electrical) industry, SIC 35. Industrial programs conservation and environment. Volume I, 3:21829 (PB—269887)
Energy efficiency improvement targets in the machinery (except electrical) industry, SIC 35. Volume 2. Target support document, 3:21830 (PB—269888)
**Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research**
Selected papers from a conference entitled "Focusing on Energy", 3:21708 (IMMR—24-M3-76)
**Kernforschungszentrum Karlsruhe (Germany, F.R.). Abt. fuer Angewandte Systemanalyse**
Development of an irradiation technology for the recycling of Am-241 in nuclear reactors. A contribution to the possibilities for the reduction of the hazard potential of α-bearing wastes, 3:21171 (KFK—2431)
**Kewanee Oil Co., Tulsa, Okla. (USA)**
North Stanley Polymer Demonstration Project. First annual report, 3:20951 (COO/0029—1)
**KVB Engineering, Inc., Tustin, Calif. (USA)**
Field testing: application of combustion modifications to control pollutant emissions from industrial boilers. Phases I and II (data supplement). Supplemental report for June 1973—September 1975, 3:22092 (PB—270112)

## L

**Lehigh Univ., Bethlehem, Pa. (USA)**
Use of fluidized bed heat exchangers in heat pump systems for improved performance. Technical status report, September 1, 1977—November 31, 1977, 3:21772 (COO/4490—1)
**Little (Arthur D.), Inc., Cambridge, Mass. (USA)**
Feasibility investigations of growing and characterizing gallium arsenide crystals in ribbon form. Semi-annual progress report 1 January—30 June 1975, 3:21280 (PB—269587)
**LMC Corp., Sparks, Nev. (USA)**
Evaluation of selected drive components for a flywheel powered commuter vehicle. Phase I. Final report, 3:21858 (SAN/1164—1)
**Los Alamos Scientific Lab., N.Mex. (USA)**
Data analysis facility at LAMPF, 3:22118 (LA—7034-MS)
Environmental investigations associated with the LASL hot dry rock geothermal energy development project, 3:21432 (LA—6972)
Fusion energy applied to synthetic fuel production: a report to the DOE Division of Magnetic Fusion Energy based on a preliminary study by an ad-hoc advisory group, 3:21243 (CONF-770593—)
Intense neutron source facility. Progress report, July 1—September 30, 1977, 3:22096 (LA—7023-PR)
Investigation of multi-charged heavy ion production in an electron beam ion source, 3:22114 (LA—7077-T)
LAMPF 201.25-MHz linac field distribution, 3:22103 (LA—6919)
LASL $Nb_3Ge$ conductor development. Eighth quarterly progress report, July 1—September 30, 1977, 3:21553 (LA—7037-PR)
Micro-NOVAC: an intelligent CAMAC controller based on a micro-NOVA computer, 3:22078 (LA—6985)
Proceedings of the second NATO-CCMS information meeting on dry hot rock geothermal energy, 3:21448 (LA—7021-C)
Scaling of reactor cavity wall loads and stresses, 3:22638 (LA—7014-MS)
Uranium mill monitoring for natural fission reactors, 3:21109 (LA—7062-MS)
**Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry**
Physico-chemical study of some areas of fundamental significance to biophysics. Final report, 1974—1977, 3:21978 (ORO—3018-180)
**Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex. (USA). Dept. of Aerosol Physics**
Criticality considerations for $^{233}U$ fuels in an HTGR fuel refabrication facility, 3:21144 (ORNL/TM—6136)
**Lummus Co., Bloomfield, N.J. (USA)**
Application of Lummus antisolvent deashing technology to a solvent refined coal solution. Final report, 3:20876 (EPRI-AF—234)
**Lund Univ. (Sweden)**
Lead, expecially exhaust lead, in the terrestrial environment: accumulation and ecological effects. A literature survey, 3:22148 (SNV-PM—794)

## M

**Maryland Univ., College Park (USA). CCMS Projects Office**
CCMS solar energy pilot study. Solar heating and cooling systems in buildings, 3:21333 (UMD—4908-10)
**Maryland Univ., College Park (USA). Dept. of Physics and Astronomy**
Proposed neutron bottle for the Argonne pulsed neutron source and its application in the search for the neutron electric dipole moment, 3:22119 (ORO—2504-267)
**Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)**
Hydrogen gas from cured RTV silicones, 3:21977 (MHSMP—77-60)
Mechanical properties of LX-10-1. Process Development Endeavor No. 105, 3:22134 (MHSMP—77-58)
Summary of chlorine free synthesis of TATB. Process Development Endeavor No. 106, 3:22133 (MHSMP—77-57)
**Massachusetts Inst. of Tech., Cambridge (USA)**
Computer-aided industrial process design: the ASPEN project. First quarterly progress report, June 1—August 31, 1976, 3:20859 (MIT—2295T9-1)
Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1—November 30, 1976, 3:20860 (MIT—2295T9-2)
**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering**
MIT LMFBR blanket research project. Quarterly progress report, July 1, 1977—September 30, 1977, 3:21580 (COO—2250-30)
**Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.**
Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976—February 28, 1977, 3:21754 (FE—2215-7)
**Massachusetts Inst. of Tech., Cambridge (USA). High Voltage Research Lab.**
Study of gas dielectrics for cable insulation. Final report, 3:21549 (EPRI-EL—220)
**Massachusetts Inst. of Tech., Cambridge (USA). National Magnet Lab.**
Superconducting magnetohydrodynamics magnet development program: Phase I. Quarterly technical progress report No. 3 (Revision A), November 1, 1976—January 31, 1977, 3:21759 (FE—2295-1)
**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**
Efficient high energy infrared third harmonic generation in gases and liquids for laser fusion applications. Quarterly progress report, September 1, 1977—November 30, 1977, 3:22019 (COO—4251-4)
Efficient third harmonic generation of $CO_2$ laser radiation in liquid $CO—O_2—SF_6$ mixtures, 3:22637 (COO—4251-5)
**Maxwell Labs., Inc., San Diego, Calif. (USA)**
High repetition rate spark gap. Final report, 3:22080 (UCRL—13718)
**McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)**
Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108—8/2)
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem, 3:21320 (SAN/1108—8/4)

Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem, 3:21321 (SAN/1108—8/5)
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108—8/3)
Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report, 3:21325 (SAN/1132—2/4)

**McDonnell Douglas Astronautics Co., St. Louis, Mo. (USA)**
Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER—582)

**Mechanical Technology, Inc., Latham, N.Y. (USA)**
Evaluation of pump used for in situ oil recovery from tar sands, 3:21103 (MTI—78TR16)

**Midwest Research Inst., Kansas City, Mo. (USA)**
Direct sampling and characterization of gaseous species responsible for fireside corrosion in fossil fuel-fired systems. Fourth quarterly progress report, January 1—March 31, 1977, 3:20928 (FE—2288-16)

**Minnesota Mining and Mfg. Co., St. Paul (USA). Technical Ceramic Products Div.**
Thermoelectric materials evaluation program. Quarterly technical task report No. 46, 3:21915 (MMM—2473-0422)

**Minnesota Univ., Minneapolis (USA)**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976—August 31, 1977, 3:21992 (COO—913-68)
Measurements of the osmotic pressure in liquid mixtures of $^3$He and $^4$He near the lambda line and tricritical point, 3:22324 (TID—27646)

**Minnesota Univ., Minneapolis (USA). Physical Electronics Lab.**
Studies of $Na_2KSb(cs)$ photocathodes. Technical report 1 July 1972—31 May 1975, 3:21871 (AD-A—042253)

**Mitre Corp., McLean, Va. (USA). METREK Div.**
Proceedings of the fuel switching forum, 3:20924 (CONF-770658—)
Review of environmental issues of the transportation of Alaskan North Slope crude oil. Final report, 3:21730 (PB—270088)
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR—7347(Vol.5))

**Mitsubishi Electric Corp., Amagasaki, Hyogo (Japan)**
Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle, 3:21592 (JAPFNR—263)

**Mobil Research and Development Corp., Paulsboro, N.J. (USA)**
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October—December 1976, 3:21257 (FE—2276-6)

**Mobil Research and Development Corp., Princeton, N.J. (USA)**
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October—December 1976, 3:21257 (FE—2276-6)

**Montana State Univ., Bozeman (USA)**
Establishment, succession, and stability of vegetation on surface mined lands in eastern Montana. Annual progress report, June 1, 1975—February 29, 1976, 3:20914 (RLO/2228/T003—2)

**Montana Univ., Missoula (USA)**
Total pion cross section measurements. Annual progress report, January 1, 1975—December 31, 1975, 3:22358 (RLO—2232-T1-4)

**Mound Lab., Miamisburg, Ohio (USA)**
Calorimetric assay of plutonium. Technical report, 3:21220 (PB—270656)
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM—2497(OP))
Safety Analysis Report for Packaging (SARP): USA/9507/BLF (ERDA—AL), Model AL-M1, 3:22012 (MLM—2447)
Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April—June 1977, 3:21172 (MLM—2463)

## N

**National Academy of Sciences, Washington, D.C. (USA)**
Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4—6, 1977, 3:20936 (NP—22802)

**National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center**
Evaluation of initial collector field performance at the Langley Solar Building Test Facility, 3:21370 (N—77-26617)
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster, 3:21279 (N—77-26222)
Test and evaluation of 23 electric vehicles for state-of-the-art assessment, 3:21856 (CONS/1011—21)

**National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center**
On three-dimensional reconstruction of optically thin solar emission sources, 3:22299 (N—77-27056)
OSO-8 x-ray observations of AM Hersoulis, 3:22296 (N—77-27050)
X-ray and gamma-ray line production by nonthermal ions, 3:22297 (N—77-27061)

**National Aeronautics and Space Administration, Houston, Tex. (USA). Lyndon B. Johnson Space Center**
Lunar sample studies, 3:21917 (N—77-27053)

**National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center**
Influence of temper condition on the nonlinear stress—strain behavior of boron—aluminum. Interim report, March—October 1976, 3:21908 (N—77-26271)

**National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center**
View on techniques of preparation of cell and tissue culture specimens for electron microscopy, 3:22233 (LBL—5638)

**National Bureau of Standards, Boulder, Colo. (USA). Electromagnetics Div.**
System for calibrating laser power meters for the range 5-1000 W, 3:22023 (PB—269777)

**National Bureau of Standards, Washington, D.C. (USA)**
Retrofitting an existing wood frame residence for energy conservation: an experimental study. Final report, 3:21785 (PB—269847)

**National Bureau of Standards, Washington, D.C. (USA). Center for Building Technology**
Hourly solar radiation data for vertical and horizontal surfaces on average days in the United States and Canada, 3:21267 (NBS-BSS—96)
HUD Utilities Demonstration Series. Volume 7. Performance analysis of the Jersey City total energy sits. Interim report, 3:21705 (PB—269517)
Urea-formaldehyde based foam insulations: an assessment of their properties and performance. Final report, 3:21773 (PB—269779)

**National Bureau of Standards, Washington, D.C. (USA). Computer Systems Engineering Div.**
Computerized site security monitor and response system, 3:21219 (PB—269346)

**National Bureau of Standards, Washington, D.C. (USA). Inst. for Applied Technology**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR—77-1314)

**National Bureau of Standards, Washington, D.C. (USA). Inst. for Basic Standards**
ac transmission line field measurements, 3:21550 (HCP/T6010—E1)
Exposure spectra from NBS vertical-beam $^{60}$Co gamma-ray source. Final report, 3:21238 (PB—269341)

**National Council on Radiation Protection and Measurements, Washington, D.C. (USA)**
Radiation protection design guidelines for 0.1 to 100 MeV particle accelerator facilities, 3:22097 (NCRP—51)

**National Inst. for Occupational Safety and Health, Salt Lake City, Utah (USA)**
Respiratory disease mortality among uranium miners as related to height, radiation, smoking, and latent period, 3:21209 (HRP—0006691)

**National Oceanic and Atmospheric Administration, Boulder, Colo. (USA)**
The METULA oil spill, 3:21019 (PB—270418)

**National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.**
First annual report on weather modification effects of cooling towers, 3:22149 (TID—27836)

**National Research Council, Washington, D.C. (USA)**
Drinking water and health. Part II, Chapters 6 and 7. A report of the safe drinking water committee. Final report, 3:22225 (PB—270423)

**National Research Council, Washington, D.C. (USA). Committee on Biosphere Effects of Extremely-Low-Frequency Radiation**
Biologic effects of electric and magnetic fields associated with proposed Project Seafarer, 3:22280 (AD-A—042515)
**National Research Development Corp., London (UK)**
Pressurized fluidized bed combustion. Quarterly technical progress report, January—March 1977, 3:20927 (FE—1511-39)
**Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)**
Experimental determination of thermal conductivity coefficient of $UO_2$ and fuel cladding contact conduction in fuel elements under reactor irradiation, 3:21902 (NIIAR-P—250)
**Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)**
Research and design-construction work of the Scientific Research Institute of Electrophysical Apparatus in the field of controlled thermonuclear fusion, 3:22576 (ORNL-tr—4531)
**Neuchatel Univ. (Switzerland). Inst. de Physique**
Proposal for an experimental program at SIN. Study of pion—nucleus scattering using a magnetic spectrometer, 3:22367 (LA-tr—84)
**New Hampshire Univ., Durham (USA). Dept. of Chemical Engineering**
Chemical equilibrium in ash-laden coal combustion systems, 3:20890 (FE—2205-7)
Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977—July 31, 1977, 3:20901 (FE—2205-8)
**Newport News Shipbuilding and Dry Dock Co., Va. (USA)**
Nuclear powered tanker. maritime design study for 600,000 DWT nuclear tanker. Volume 2. Preliminary design. Final report, 3:21629 (PB—269724)
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 3. Ship safety. Final report, 3:21630 (PB—269725)
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 4. Engineering and production support. Final report, 3:21631 (PB—269726)
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 5. Economic evaluation. Final report, 3:21632 (PB—269727)
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 1. Preliminary specifications (Mod 1). Final report, 3:21628 (PB—269723)
**New Zealand Energy Research and Development Committee, Auckland**
Methanol from natural gas for engine fuel. 2nd interim report. Report No. 23, 3:21868 (NP—22771)
**North Dakota State Univ., Fargo (USA). Dept. of Chemistry**
Material balance in coal. 2. Oxygen determination and stoichiometry of 33 coals, 3:20888 (COO—2898-10)
**Notre Dame Univ., Ind. (USA). Coll. of Engineering**
Microstructural effects in abrasive wear. Quarter progress report, June 16—September 15, 1977, 3:21878 (COO—4246-2)
**Notre Dame Univ., Ind. (USA). Radiation Lab.**
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967—September 1977, 3:22264 (COO—38-1838)
**Nuclear Regulatory Commission, Washington, D.C. (USA)**
Joint ERDA-NRC task force on safeguards. Final report, July 12, 1976, 3:21218 (ERDA—77-34)
**Nuclear Regulatory Commission, Washington, D.C. (USA). Office of Nuclear Reactor Regulation**
NRC program for the resolution of generic issues related to nuclear power plants. (Includes plans for the resolution of "unresolved safety issues" pursuant to Section 210 of the Energy Reorganization Act of 1974, as amended), 3:21594 (NUREG—0410)
**NUS Corp., Rockville, Md. (USA)**
As low as is reasonably achievable (ALARA) studies relative to the NWTS program, 3:21211 (Y/OWI/SUB—77/42509)

## O

**Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)**
National Uranium Resource Evaluation Program. Hydrogeochemical and Stream Sediment Reconnaissance Program in Central United States. Fourth quarter FY-1977, July 1—September 30, 1977, 3:21125 (K/UR—3(Pt.5))
**Oak Ridge National Lab., Tenn. (USA)**
Advanced fuel recycle program progress report, July 1—September 30, 1977, 3:21153 (ORNL/TM—6092)
Assessment of fibrous insulation materials for the selenide isotope generator system, 3:21241 (ORNL/TM—5908)
Design features of the ELMO Bumpy Torus Reactor (EBTR), 3:22537 (CONF-771109—65)
Dynamics of high energy runaway electrons in the Oak Ridge tokamak, 3:22455 (ORNL/TM—6103)
ELMO Bumpy Torus, 3:22536 (CONF-771109—57)
Environmental aspects of transmission lines: a selected, annotated bibliography, 3:21531 (ORNL/EIS—122)
Evaluation of the fatigue resistance of CDA 182 copper for use in the impurity study experiment fusion research tokamak (ISX), 3:22682 (ORNL—5302)
Fast ramp superconductor for ohmic heating coils, 3:22592 (CONF-771029—180)
Formerly utilized MED/AEC sites remedial action program. Radiological survey of the Middlesex Sampling Plant, Middlesex, New Jersey. Final report, 3:21208 (DOE/EV—0005-1)
Fusion-fission analogy, 3:22404 (CONF-771109—85)
Heat recovery equipment for engines, 3:21847 (ANL/CES/TE—77-4)
Helium distribution system for the Large Coil Test Facility (LCTF), 3:22594 (CONF-771029—193)
Internal combustion piston engines, 3:21846 (ANL/CES/TE—77-1)
Isolation of pathogenic Naegleria from artificially heated waters, 3:22228 (CONF-770961—3)
Macroscopic stability and $\beta$ limits in the ELMO Bumpy Torus, 3:22476 (ORNL/TM—5967)
Mechanical design of ORPUS-3, 3:22591 (CONF-771029—149)
New ORNL neutral beam transport system, 3:22615 (CONF-771029—147)
Oak Ridge TNS Program 1976—1977. Integration of engineering reality brings us closer to realizable reactor, 3:22534 (CONF-771029—150)
ORMAK upgrade ohmic coil generator protection, 3:22603 (ORNL/TM—6079)
Reaction of uranyl nitrate solutions with amberlite IRC-72 cation exchange resin at 30°C: a kinetic investigation for the HTGR fuel recycle plant, 3:21152 (ORNL/TM—5866)
Remote servicing considerations for near term tokamak power reactors (TNS). Final summary, 3:22678 (CONF-771109—84)
Report of survey of valve industry capabilities, 3:20849 (CONF-771145—2)
Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM—6108)
Source term assessment concepts for LMFBRS: Aerosol Release and Transport (ART) Analytical Program, 3:21643 (ORNL/NUREG/TM—124)
Status of materials development for molten salt reactors, 3:21587 (ORNL/TM—5920)
Status of the USA program on the development of submillimeter lasers to measure ion temperatures, 3:22419 (CONF-770954—5)
U.S. nonproliferation policy and the reactions of the technical community, 3:22139 (CONF-771055—1)
Wall power measurements of impurity radiation in ORMAK, 3:22579 (ORNL/TM—6148)
**Oak Ridge Y-12 Plant, Tenn. (USA)**
Investigation of a lithium electrolytic cell failure, 3:21986 (Y—2107)
**Ohio State Univ. Research Foundation, Columbus (USA)**
High energy physics studies progress report. Part I. Experimental program, 3:22326 (COO—1545-222)
**Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry**
Mass spectrometric analytical services and research activities to support coal-liquid characterization research. Quarterly report, June 9—September 30, 1977, 3:20874 (BERC—0020-9)
**Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering**
Catalysts for upgrading coal-derived liquids. Quarterly report, June 9—September 8, 1977, 3:20878 (FE—2011-9)

**Oklahoma Univ., Norman (USA)**
Proceedings of the gas conditioning conference, 3:21067 (CONF-7603113—)
**Ontario Ministry of Natural Resources, Toronto (Canada)**
Blind River uranium deposits: the ores and their setting, 3:21110 (MP—65)
**Oxford Univ. (UK). Dept. of Engineering Science**
Failure analysis of pressure vessels with defects. Progress report, September 1976, 3:21640 (N—77-26550)
Microcomputer-based reactor safety system, 3:21641 (N—77-26941)

## P

**Parsons (Ralph M.) Co., Pasadena, Calif. (USA)**
Cresap Test Center inspection and acceptance services. R and D report No. 82, interim report No. 8, 3:20877 (FE—1234-8)
**Pennsylvania State Univ., University Park (USA)**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061—)
**Pennsylvania State Univ., University Park (USA). Coal Research Section**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April—June 1977, 3:20889 (FE—2030-8)
**Pennsylvania State Univ., University Park (USA). Dept. of Biochemistry and Biophysics**
Basic aspects of radiation action on microorganisms. Final report for the period ending October 31, 1977, 3:22252 (COO—2362-27)
**Pennsylvania State Univ., University Park (USA). Materials Research Lab.**
Borehole cement and rock properties studies: progress report, October 1, 1976—September 30, 1977, 3:21190 (Y/OWI/SUB—4091/6)
**Pennsylvania Univ., Philadelphia (USA)**
Placental transport of radionuclides. Terminal report, May 1, 1973—July 31, 1975, 3:22268 (COO—2363-4)
Research and development of low-cost processes for integrated solar arrays. Semi-annual report No. 3, 1 January—30 June 1975, 3:21281 (PB—269670)
**Pennsylvania Univ., Philadelphia (USA). Dept. of Mechanical Engineering and Applied Mechanics**
Modeling of arc discharges in power circuit breakers. Final report, 3:21529 (EPRI-EL—482)
**Pennzoil Co., Vienna, W.Va. (USA)**
Oil recovery by carbon dioxide injection. Annual report, July 1976—July 1977, 3:20954 (ORO—5301-18)
**Pittsburgh Univ., Pa. (USA)**
Uranium atoms and ions in the gas phase. Progress report, March 1, 1977—February 28, 1978, 3:21141 (COO/4295—1)
**Power Reactor and Nuclear Fuel Development Corp., Oarai (Japan)**
Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle, 3:21592 (JAPFNR—263)
Transient boiling of sodium in a 19-pin bundle under loss-of-flow conditions, 3:21658 (JAPFNR—262)
**Pratt and Whitney Aircraft, West Palm Beach, Fla. (USA). Government Products Div.**
Wear resistant coatings for titanium alloys. Final report 15 March 1976—15 March 1977, 3:21872 (AD-A—042443)
**Price Waterhouse and Co., Washington, D.C. (USA). Office of Government Services**
Digest of Federal Registers, 3:21733 (PB—270153)
Reference guide to changes in refiner and reseller pricing regulations and rulings, 3:21731 (PB—270151)
Reference guide to changes in reseller pricing regulations and rulings, 3:21732 (PB—270152)
**Princeton Univ., N.J. (USA). Center for Environmental Studies**
Feedback as a means of decreasing residential energy consumption. Report PU/CES 34, 3:21784 (COO/2789—1)
**Princeton Univ., N.J. (USA). Plasma Physics Lab.**
Feasibility of beam driven semi-catalyzed deuterium fusion neutron sources for hybrid reactor applications, 3:22683 (PPPL—1399)
Higher-order multipoles and splines in plasma simulations, 3:22457 (PPPL—1404)
Ion energy balance in ohmically heated PLT discharges, 3:22449 (PPPL—1403)
Low-noise control valve. II, 3:22607 (CONF-771029—153)
Measurements of the parametric decay of $CO_2$ laser radiation into plasma waves at quarter critical density using ruby laser Thomson scattering, 3:22420 (PPPL—1394)
Plasma engineering studies for the tokamak experimental power reactor, 3:22535 (CONF-771029—190)
Random phase wave: a soluble non-Markovian system, 3:22456 (PPPL—1401)
Stabilization of the axisymmetric instability in the PDX tokamak, 3:22478 (PPPL—1400)
Theory and numerical simulations on collisionless drift instabilities in three dimensions, 3:22477 (PPPL—1397)
**Pullman Kellogg, Houston, Tex. (USA)**
Supply of carbon dioxide for enhanced oil recovery. Final report, October 15, 1976—September 1, 1977, 3:20953 (FE—2515-10)
**Purdue Univ., Lafayette, Ind. (USA)**
Material selection considerations for fluoride thermal energy storage containment in a sodium heat pipe environment. Final report 1 June—August 1976, 3:21671 (AD-A—042389)
**Purdue Univ., Lafayette, Ind. (USA). School of Industrial Engineering**
Valued renewal processes, 3:22002 (SAND—77-1436C)

## R

**Research Triangle Inst., Research Triangle Park, N.C. (USA). Systems and Measurements Div.**
Oxidant-precursor relationships during pollutant transport conditions. An outdoor smog chamber study. Final report May 1974—November 1975, 3:22147 (PB—269877)
**Resource Planning Associates, Inc., Cambridge, Mass. (USA)**
Developing a SNG feedstock allocation scheme that reflects a sound national policy on SNG. Attachment A. Worksheets for efficiency, costs, and emissions analysis. Attachment B. Major sources of data, 3:21738 (TID—28025)
**Resource Planning Associates, Inc., Washington, D.C. (USA)**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879—1(Vol.2))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume I, 3:21681 (HCP/M3879—1(Vol.1))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Executive summary, 3:21682 (HCP/M3879—0003)
**Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Essen (Germany, F.R.). Abt. Anwendungstechnik**
Possibilities of solar space heating, 3:21328 (AED-Conf—1977-053-004)
**Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab. TNO**
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457, 3:22224 (N—77-26934)
**Rochester Univ., N.Y. (USA). Dept. of Chemistry**
New advances in isotope separation, 3:21140 (COO—3498-30)
**Rockwell International Corp., Anaheim, Calif. (USA). Autonetics Group**
Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July—September 1977, 3:21275 (ERDA/JPL/954458—77/6)
**Rockwell International Corp., Creve Couer, Mo. (USA). Air Monitoring Center**
Regional air pollution study. point source emission inventory. Final report, 3:22146 (PB—269567)
**Rocky Mountain Coal Mining Inst., Denver, Colo. (USA)**
Rocky Mountain Coal Mining Institute. 72nd regular meeting, 3:21725 (CONF-7606160—)

## S

**Saberian (A.) and Associates, Austin, Tex. (USA)**
National waste terminal storage program, 3:21189 (Y/OWI/SUB—77/16537)
**Sandia Labs., Albuquerque, N.Mex. (USA)**
Archaeological reconnaissance of a proposed site for the Waste Isolation Plant (WIPP), 3:21167 (SAND—77-7024)
Data aquisition and processing system, 3:22129 (SAND—77-1914C)
Discussion of diagnostics techniques in particle beam fusion at Sandia Laboratories, 3:22421 (SAND—77-1829C)
Estimating monthly means of daily totals of direct normal solar radiation and of total solar radiation on a south-facing, 45°, tilted surface, 3:21268 (SAND—77-0874)
Flow visualization in heat-generating porous media, 3:21644 (SAND—76-0614)
Hybrid trajectory simulation of the B77 system, 3:22140 (SAND—77-8040)
Insider safeguards effectiveness model (ISEM). User's guide, 3:21221 (SAND—77-0043)
Instrumentation and process control development for in situ coal gasification. Tenth and eleventh quarters' report: March—August 1977, 3:20862 (SAND—77-1821)
Locating a buried earth penetrator, 3:22001 (SAND—77-0646)
Recent developments in the Sandia Laboratories' sewage sludge irradiation program, 3:21240 (SAND—77-1411)
Recent operational history of the new Sandia Pulsed Reactor III (SPR III), 3:21625 (SAND—77-1116C)
Scintillator-photomultiplier response to a simulated REB generated thermonuclear neutron pulse, 3:22641 (SAND—77-1592C)
Solar energy research at Sandia Laboratories with unique health and safety parameters, 3:21271 (SAND—77-1412C)
Speed, acceleration, and pulse prediction calculations on test vehicles with wheel pulse generators, 3:21859 (SAND—78-0030C)
Stability of multiple shell ICF capsules, 3:22640 (SAND—77-1495C)
Starting an ODE solver, 3:22692 (SAND—77-1023)
Symmetrical $\pi$ and T attenuators: design data for component power dissipation and resistance, 3:22079 (SAND—77-1599)
User's manual for the CDC-6600 version of AMPX, 3:22385 (SAND—77-1148)
Valued renewal processes, 3:22002 (SAND—77-1436C)
**Sandia Labs., Livermore, Calif. (USA)**
Analysis of thermally degraded sensible heat storage hydrocarbons, 3:21384 (SAND—77-8264)
**Schafer (W.J.) Associates, Inc., Arlington, Va. (USA)**
Investigation of possibilities for solar powered high energy lasers in space. Final report, 3:22020 (N—77-26478)
**Schleswag A.G., Rendsburg (Germany, F.R.)**
Experiences with heat pumps in heat recovery from the ground, 3:21771 (AED-Conf—1977-072-010)
**Schweizerisches Inst. fuer Nuklearforschung, Villigen**
Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions, 3:22332 (LA-tr—77-76)
Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering, 3:22338 (LA-tr—77-74)
Proposal for an experimental program at SIN. Study of pion—nucleus scattering using a magnetic spectrometer, 3:22367 (LA-tr—84)
**SEE ALSO- 6413040 UKAEA Reactor Group, Risley**
Technology and assessment of neutron absorbing materials, 3:21884 (TRG-Report—2953(S))
**Sensor Technology, Inc., Chatsworth, Calif. (USA)**
Development of low-cost, high energy-per-unit-area solar cell modules. Quarterly report No. 3, July 1, 1977—September 30, 1977, 3:21277 (ERDA/JPL/954605—77/3)
**Shriver (R.) Associates, Parsippany, N.J. (USA)**
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G—77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G—77/357)
**Sigma Research, Inc., Richland, Wash. (USA)**
Use of two-phase heat transfer for improved transformer cooling. Final report, 3:21530 (EPRI-EL—588)
**Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren**
Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress, 3:21874 (ZJE—186)
**Skogshoegskolan, Stockholm (Sweden)**
Survival and dry matter production of some high-yield clones of SALIX and POPULUS selected for forest industry and energy production. Pilot study, 3:21259 (SHS-IFSY-RU—3)
**Stanford Linear Accelerator Center, Calif. (USA)**
New look at the nuclear force, 3:22380 (SLAC-PUB—1601)
Possible connections between hard and soft processes, 3:22347 (SLAC-PUB—2051)
Properties of the psi resonances, 3:22339 (SLAC-PUB—1602)
Relativistic interactions between nuclei, coherence effects and nonscaling, 3:22381 (SLAC-PUB—2010)
**Stanford Research Inst., Menlo Park, Calif. (USA)**
Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power, 3:21427 (SAN—115P108-1(Vol.2))
Economic analyses of geothermal energy development in California, 3:21428 (SAN—115P108-1(Vol.1))
Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977—July 31, 1977, 3:21276 (ERDA/JPL/954471—77/3)
**Stanford Univ., Calif. (USA)**
High magnetic field MHD generator program. Quarterly report, January—March 1977, 3:21765 (FE—2341-2)
**Stanford Univ., Calif. (USA). Dept. of Materials Science and Engineering**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report, 3:21556 (EPRI-NP—567)
**Stanford Univ., Calif. (USA). Digital Systems Lab.**
Studies in the organization of computer systems. 1977 progress summary. Technical note No. 121, 3:22693 (SU—326-P.39-26)
**Statens Industriverk, Stockholm (Sweden)**
Industry in national planning: the power industry, 3:21742 (SIND-PM—1977-3)
**Statens Straalskyddsinstitut, Stockholm (Sweden)**
General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants, 3:22260 (ORNL-tr—4547)
**State Univ. of New York, Stony Brook (USA). Dept. of Materials Science**
Vacancy properties in gold, 3:21877 (CONF-761027—25)
**State Univ. of New York, Stony Brook (USA). Inst. for Energy Research**
Energy information and analytic system for New York State, 3:21679 (BNL—22677)
**STD Research Corp., Arcadia, Calif. (USA)**
U-25-C MHD channel analysis open circuit operation. Interim report: Subtask 1 (B). Revision A, 3:21764 (FE—2243-9)
**Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica**
Experimental and theoretical work in plasma physics. Annual status report, 31 December 1975, 3:22448 (N—77-26985)
Screw pinch approach to controlled fusion, 3:22454 (INIS-mf—3355)
**Stuttgart Univ. (TH) (Germany, F.R.). Inst. fuer Plasmaforschung**
Experimental investigation of the operating characteristic of a plasma focus, 3:22447 (LA-tr—77-69)
**Systems Research Labs., Inc., Dayton, Ohio (USA)**
CDIF-MHD generator system conceptual design, 3:21755 (TID—27152)
**Systems, Science and Software, La Jolla, Calif. (USA)**
Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977—March 31, 1977, 3:20854 (FE—1770-26)

## T

**Technische Hogeschool Eindhoven (Netherlands). Afdeling der Elektrotechniek**
Numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature, 3:21760 (N—77-26439)

**Technische Univ. Muenchen (Germany, F.R.). Fachbereich Chemie, Biologie und Geowissenschaften**
Development of an irradiation technology for the recycling of Am-241 in nuclear reactors. A contribution to the possibilities for the reduction of the hazard potential of $\alpha$-bearing wastes, 3:21171 (KFK—2431)
**Teledyne Brown Engineering, Huntsville, Ala. (USA)**
Solar energy: soybean drying facility (Jan 1977) (Engineering Materials), 3:21362 (CAPE—2607)
**Tennessee Valley Authority, Chattanooga (USA)**
TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January—September 1976, 3:21525 (PB—269850)
**Tennessee Valley Authority, Chattanooga (USA). Div. of Environmental Planning**
Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76, 3:22212 (PB—269652)
**Tera Corp., Berkeley, Calif. (USA)**
Draft environmental impact statement. High-level waste repository site suitability criteria, 3:21182 (UCRL—13804)
**Terra Tek, Inc., Salt Lake City, Utah (USA)**
Full-scale laboratory drilling tests on sandstone and dolomite. Final report, 3:20952 (COO/4098—1)
**Texas A and M Univ., College Station (USA). Dept. of Chemistry**
Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976—July 31, 1977, 3:20858 (FE—2467-4)
**Texas Univ., Austin (USA)**
TEXT Energy Storage System, 3:22604 (ORO—5594-9)
**TRW Systems and Energy, Redondo Beach, Calif. (USA)**
Use of geothermal heat for sugar refining. Final report, October 1, 1976—May 31, 1977, 3:21450 (SAN/1317—3)
**TRW Systems Group, McLean, Va. (USA)**
Combustion of Alternative Fuel Study (CAFS), 3:21258 (SAN—1261/1)

## U

**UKAEA Research Group, Harwell. Atomic Energy Research Establishment**
Studies on the thermal decomposition of nitrates found in highly active waste and of chemicals used to convert the waste to glass, 3:21168 (AERE-R—8735)
**Union Carbide Corp., Oak Ridge, Tenn. (USA). Office of Waste Isolation**
Evaluation of hydrologic isolation from evidence in mine openings in igneous and metamorphic rocks in the Maritime Provinces of Canada, 3:21181 (ORNL/Sub—4415)
**United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)**
Commercial electric power cost studies. Capital cost, Pressurized Heavy Water Reactor Plant, 3:21596 (COO—2477-13(Vol.1))
**United Technologies Corp., Farmington, Conn. (USA). Power Systems Div.**
Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan, 3:21485 (FE—2292-9)
**Utah Engineering Experiment Station, Salt Lake City (USA)**
Home energy savers program: a little time can save a lot of money, 3:21709 (TID—28047)

## V

**Vanderbilt Univ., Nashville, Tenn. (USA). Dept. of Physics and Astronomy**
Nuclear pumped laser. II. Final contractor report, August 1975—August 1977, 3:22021 (N—77-26479)
**Varian Associates, Lexington, Mass. (USA). Lexington Vacuum Div.**
Slicing of silicon into sheet material. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Sixth quarterly report, June 18, 1977—September 18, 1977, 3:21274 (ERDA/JPL/954374—77/3)
**Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April—June 1977, 3:20916 (FE—1231-9)
**Virginia Univ., Charlottesville (USA). Research Labs. for the Engineering Sciences**
Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976—August 1977, 3:20840 (FE—2479-1)

## W

**Washington Univ., Seattle (USA)**
Delayed neutron spectra from $^{232}$Th, $^{233}$U, $^{235}$U, and $^{239}$Pu, 3:22379 (RLO/2225/T3—6)
**Washington Univ., Seattle (USA). Dept. of Genetics**
Average number of generations until extinction and rate of allelism of lethal genes in a sub-divided population, 3:22239 (RLO/2225/T5—35)
**Water Purification Associates, Cambridge, Mass. (USA)**
Water conservation and pollution control in coal conversion processes. Final report June 1975—December 1976, 3:20913 (PB—269568)
**Water Resources Council, Washington, D.C. (USA)**
Water supplies and the nuclear licensing process, 3:21595 (PB—270463)
**Western Biological Labs., Culver City, Calif. (USA)**
Hydrocarbon and oxidant chemistry observed at a site near St. Louis. Final report 30 June 1975—30 June 1976, 3:22145 (PB—269559)
**Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.**
Clinch River Breeder Reactor Plant. Effects of thermal aging on CRBRP primary piping, 3:21582 (CRBRP-ARD—0188)
Clinch River Breeder Reactor Plant. Integrity of primary and intermediate heat transport system piping in containment, 3:21635 (CRBRP-ARD—0185(Vol.1))
Clinch River Breeder Reactor Plant. Internal/external cladding degradation, 3:21581 (CRBRP-ARD—0147)
Radial parfait core design study, 3:21590 (WARD—353)
**Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Advanced Energy Systems Div.**
Summary report on investigation of metal processing operations. Final report 15 December 1973—22 March 1977, 3:21870 (AD-A—042188)
**Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Fusion Power Systems Dept.**
Computer code for the costing and sizing of TNS tokamaks, 3:22544 (WFPS-TME—062)
EPR ohmic heating energy storage, 3:22605 (WFPS-TME—064)
Impurity and gas throughput control for TNS, 3:22580 (WFPS-TME—060)
Physics of tritium breeding as a geometric programming problem, 3:22630 (WFPS-TME—068)
Thermal design and analysis of superconductors for the toroidal field coils of TNS, 3:22597 (WFPS-TME—059)
**Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Research and Development Center**
Laser discharges in attaching gases, June 25, 1976—June 24, 1977. Final report, 3:22018 (COO—4030-4)
**Westinghouse Research Labs., Pittsburgh, Pa. (USA)**
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N—77-26628)
Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report, 3:21474 (N—77-26630)
Thin film solar cells for terrestrial applications. Quarterly progress report no. 4, 1 April—30 June 1975, 3:21282 (PB—269671)
**West Virginia Geological Survey, Morgantown (USA)**
Some practical considerations in x-radiography, 3:21101 (MERC/SP—77/7)
**West Virginia Univ., Morgantown (USA). Coal Research Bureau**
Coal minerals bibliography. Quarterly report No. 1, June 15—September 15, 1977, 3:20892 (FE/2692—1)
**West Virginia Univ., Morgantown (USA). Dept. of Geology**
Prediction model for compositional changes within a coal from core data. Quarterly report, September—December 1976, 3:20891 (FE—5065-2)

**Wisconsin Univ., Milwaukee (USA). Dept. of Physics**
Comparative study of electron—phonon interaction in three vanadium samples of varying purity. Interim report1 October 1973—30 September 1975, 3:21880 (AD-A—042702)

**Woods Hole Oceanographic Institution, Mass. (USA)**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976—September 30, 1977, 3:22220 (COO—3568-18)

**Wyle Labs., Huntsville, Ala. (USA)**
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report, 3:21369 (N—77-26610)

**Wyoming Univ., Laramie (USA). Dept. of Electrical Engineering**
Remote electromagnetic sensing of underground coal burns. Quarterly technical progress report, March—May 1977, 3:20857 (FE—2414-4)

## Z

**Zurich Univ. (Switzerland)**
Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr—77-75)

Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr—77-67)

Effect of pions on the embryonal development of the mouse, 3:22263 (LA-tr—77-77B)

# AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. Report numbers, if applicable, are given in parentheses at the end of the entry. For publications with multiple authors, an author entry is provided for each. Entries for the second and succeeding author give a reference to first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

## A


**Abasova, T.M.,** *See* Papok, K.K., 3:20998
**Abdel-Khalik, S.I.,** Engineering design aspects for SOLASE, 3:22668
*See* Conn, R.W., 3:22667
*See* Moses, G.A. Conn, R.W., 3:22669
**Abdou, M.A.,** Wall load and lifetime goals for tokamak power plants, 3:22586
**Abdul'manov, V.G.,** B-5 proton-ion synchrotron, 3:22100 (UCRL-Trans—1542)
**Abdulin, F.S.,** Problem of determination of the magnitude of anomalous oil layers clogging bottom hole zones of strata, 3:20974
**Abramov, Yu.I.,** Formation of coarsely dispersed moisture on the trailing edges of nozzle rings of saturated steam turbines, 3:21504
**Abrams, G.S.,** *See* Meyer, D.I., 3:22327
*See* Perl, M.L., 3:22328
**Abrams, L.A.,** As low as is reasonably achievable (ALARA) studies relative to the NWTS program, 3:21211 (Y/OWI/SUB—77/42509)
**Abramzon, L.S.,** *See* Syrtlanov, R.Sh., 3:21037
**Adachi, S.,** *See* Fujita, T., 3:22490
*See* Ohnuki, S., 3:22429
**Adair, R.K.,** *See* Grannan, D.M., 3:22331
**Afanas'ev, B.P.,** *See* Godik, I.B., 3:21488
**Afonin, A.G.,** Neutrino beam of the Institute of High-Energy Physics. II. Characteristics of the 70-GeV proton beam extracted for neutrino experiments, 3:22117
**Agaev, G.F.,** Investigation of the motion of a solid particle under the conditions of the rotary method of drilling, 3:20972
**Agaev, S.G.,** Dynamic models used in planning operating parameters, 3:20964
**Agafonov, A.V.,** *See* Alekhina, N.I., 3:21001
**Ageev, A.I.,** Results of experiments on the rf superconducting accelerating section of the collective accelerator. II, 3:22108
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**Aggerbeck L.,** *See* Tardieu, A., 3:22232
**Ahlstrom, H.G.,** *See* Brooks, K.M., 3:22424
*See* Kornblum, H.N., 3:22425
*See* Manes, K.R., 3:22647
**Aiken, J.,** Three-laser intercavity interferometer for the study of low-density plasmas, 3:22432
**Aitken, J.H.,** Continuous and grab sampling determinations of radon concentrations, 3:22167 (HASL—325, pp 17-19)
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL—325, pp 129-131)
**Akers, D.J.,** Coal minerals bibliography. Quarterly report No. 1, June 15—September 15, 1977, 3:20892 (FE/2692—1)
**Akhmadullina, A.G.,** *See* Mazagarov, A.M., 3:21086
**Akhmedov, A.A.,** *See* Shalaikin, A.F., 3:21080
**Akhmedov, Ch.M.,** *See* Nadzhafov, E.M., 3:20976
**Akhmedov, D.,** *See* Ismailov, I., 3:22053
**Aki, K.,** *See* Chouet, B., 3:21407
**Akimoto, H.,** *See* Hishinuma, Y., 3:20906
**Akimov, Y.,** Diffraction dissociation of high-energy protons on hydrogen and deuterium targets, 3:22333
**Akita, Y.,** *See* Michiyoshi, I., 3:22609
**Aksenov, L.F.,** Residential solar heating in Uzbekistan, 3:21335
**Al'tshuller, M.A.,** *See* Margulova, T.Kh., 3:21561
**Al-Shahristani, H.,** *See* Yousif, A.N., 3:21932
**Alam, M.S.,** *See* Meyer, D.I., 3:22327
*See* Perl, M.L., 3:22328
**Alanakyan, Y.R.,** Stability of a low-temperature plasma, 3:22500
**Albo, M.,** Does temperature affect electric resistivity of rocks in the Larderello region, 3:21404 (NP—22319)
**Alei, M. Jr.,** Gas phase $^{13}C$ chemical shifts and coupling constants in the deuteromethanes, 3:22309
**Alekhina, N.I.,** High-v.i. lubricating oil produced by adsorptive treatment of heavy catalytic gas oil, 3:21001
**Aleksandrov, I.A.,** *See* Turevskii, E.N., 3:20995
**Alekseev, G.A.,** *See* Abdulin, F.S., 3:20974
**Alekseevskii, V.P.,** *See* Pan, V.M., 3:21913
**Alexander, W.O.,** Economics of energy and materials, 3:21816
**Alexandrov, A.J.,** Starting material radiation source for Moessbauer investigations of tellurium compounds, 3:21239
**Aliev, V.A.,** *See* Gurbanov, R.S., 3:20975
**Alikaev, V.V.,** Instabilities in the TM-3 tokamak connected with runaway electron beam, 3:22504
Superthermal X radiation in the TM-3 tokamak, 3:22453
**Alkhutov, M.S.,** *See* Dement'ev, B.A., 3:21515
**Allaire, P.E.,** *See* Lewis, D.W., 3:20840
**Allen, B.J.,** *See* Musgrove, A.R.L., 3:22366
**Allentuck, J.,** *See* Carroll, T.O., 3:21679
**Aloia, J.,** *See* Cohn, S.H., 3:22244
**Alsmiller, F.S.,** *See* Alsmiller, R.G. Jr., 3:22192
**Alsmiller, R.G. Jr.,** Monte Carlo simulation of turbulent atmospheric transport: comparison with experimental data, 3:22192
**Amann, J.F.,** *See* Perry, D.G., 3:22118
**Amaya, T.,** *See* Nakamura, A., 3:21444
**Amemiya, H.,** Suppression of the plasma oscillation by a wave perturbation on the beam distribution function, 3:22518
**Amer, N.M.,** *See* Gerlach, R., 3:22150
**Ames, H.S.,** Proposal for development of an interactive project management code, 3:22688 (UCID—17613)
**Ametov, I.M.,** Models accounting for the phenomenon of delay in liquid filtration through a porous medium, 3:20968
**Amos, D.E.,** *See* Nunziato, J.W., 3:22136
**Amosov, V.V.,** Experience in local treatment of wastewaters from petrochemical production, 3:21013
**Anderl, L.,** Installation permitting the recuperation of heat from waste water and the saving of water, 3:21780
**Anderl, R.A.,** *See* Greenwood, R.C., 3:22360
*See* Helmer, R.G., 3:22359
**Anderson, J.H.,** *See* Prelas, M.A., 3:22673
**Anderson, L.A.,** Mapping lateral boundaries of a cooling basaltic lava lake using ELF and VLF induction techniques, Kilauea Iki, Hawaii, 3:21406
**Anderson, O.A.,** *See* Hooper, E.B. Jr., 3:22621
**Anderson, R.C.,** Investigation of a lithium electrolytic cell failure, 3:21986 (Y—2107)
**Anderson, W.,** *See* Kaufman, H.A., 3:21797
**Andre-Talamon, T.,** *See* Murat, M., 3:21853
**Andreev, S.I.,** High-current pinches in xenon. II. Z pinch, 3:22413
**Andronov, G.A.,** Gasdynamic laser using a CO—Ar mixture, 3:22047
**Angelini, A.M.,** Evolution of energy resources and their utilization: role of heat, 3:21711
**Angino, E.E.,** High-level and long-lived radioactive waste disposal, 3:21193
**Anishchenko, N.G.,** *See* Ageev, A.I., 3:22107, 3:22108
**Anon,** Nuclear data sheets, 3:22353

**Anosova, L.M.,** Neutralization of the charge of an electron beam in a plasma, 3:22468
**Anspaugh, L.R.,** Geothermal environmental overview project, 3:21433 (UCID—17632)
**Antic, S.,** Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
**Ao, N.,** *See* Ohnishi, M., 3:22587
**Apai, G.R. II,** Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL—6906)
**Aparisi, R.R.,** *See* Teplyakov, D.I., 3:21322
**Apostolova, I.V.,** *See* Bibikov, G.G., 3:21017
**Appel, H.,** Proposal for an experiment at SIN: dosimetry of the πE3 beam: determination of the beam components, 3:22111 (LA-tr—77-70)
**Appel, J.A.,** *See* Kephart, R.D., 3:22334
**Appelman, E.H.,** *See* Thompson, R.C., 3:21959
**Apps, J.,** *See* Bowman, H., 3:21412
**Apt, K.E.,** Uranium mill monitoring for natural fission reactors, 3:21109 (LA—7062-MS)
**Arai, Y.,** Simulation of product distributions from pyrolysis of normal and branched alkane mixtures over a wide range of conversions, 3:20989
**Arakelyan, E.K.,** *See* Dorokhov, E.V., 3:21537
**Arbuzov, V.A.,** *See* Sirina, T.P., 3:21844
**Arbuzova, N.A.,** *See* Sirina, T.P., 3:21844
**Archer, V.E.,** Respiratory disease mortality among uranium miners as related to height, radiation, smoking, and latent period, 3:21209 (HRP—0006691)
**Archibald, R.G.,** Philosophies of safety in sour gas processing, 3:21087 (CONF-7603113—, pp A1-A13)
**Arecchi, F.T.,** *See* Bertotti, B., 3:22656
**Arendt, J.W.,** National Uranium Resource Evaluation Program. Hydrogeochemical and Stream Sediment Reconnaissance Program in Central United States. Fourth quarter FY-1977, July 1—September 30, 1977, 3:21125 (K/UR—3(Pt.5))
**Arifov, P.U.,** Capture of positrons by radiation defects in germanium, 3:21898
**Arikawa, Y.,** *See* Hishinuma, Y., 3:20906
**Armer, A.G.,** *See* Andronov, G.A., 3:22047
**Arnett, R.C.,** Hanford groundwater transport estimates for hypothetical radioactive waste incidents, 3:22223 (ARH-LD—162)
**Arola, R.,** Forest industry energy program: direct conversion, 3:21305 (CONF-770235—, pp 37p, Paper 3)
**Arthur, A.A.,** *See* Franck, J.V., 3:22602
**Artigas, R.,** *See* Clayton, E.D., 3:21215
**Arutyunov, N.Y.,** *See* Arifov, P.U., 3:21898
**Asakura, S.,** *See* Dokiya, M., 3:21249
**Asaro, F.,** *See* Bowman, H., 3:21412
**Asch, L.,** *See* Dunlap, B.D., 3:21969
**Ascher, G.,** Economical photovoltaic power generation with heat recovery, 3:21291
**Asperger, R.G.,** Corrosion control in gas processing plants which remove both $CO_2$ and $H_2S$, 3:21068 (CONF-7603113—, pp B1-B19)
**Aten, J.B.T.,** *See* Vanhemmen, J.J., 3:22224
**Athans, M.,** Stability of interconnected systems, 3:21539
**Attenberger, S.E.,** *See* Peng, Y-K.M., 3:22561
**Attwood, D.T.,** *See* Boyle, M.J., 3:22646
**Atwood, J.M.,** Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME—77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME—77-38)
**Auer, I.P.,** Measurements of the total cross-section difference and the parameter Csub(LL) in pp scattering with longitudinally polarized beam and target, 3:22335
**Auger, W.,** Experiences in tunnel-kiln coal firing and related pollution control, 3:21811 (CONF-770658—, pp 177-186)
**Aureille, R.,** Operation of an electroprecipitator influence of the main parameters, 3:21526
**Auslender, V.L.,** *See* Abdul'manov, V.G., 3:22100
**Ausmees, V.I.,** *See* Tager, S.A., 3:20930
**Austin, W. H. Jr.,** Geothermal power emerging as an alternate energy source, 3:21391
Processes of heat accumulation and geothermal resource formation, 3:21451
**Avanesyan, V.S.,** Electron-beam-controlled laser with a grid-controlled electron gun, 3:22055
**Averbukh, I.I.,** *See* Abdul'manov, V.G., 3:22100
**Avezov, R.R.,** *See* Aksenov, L.F., 3:21335
*See* Umarov, G.Ya., 3:21363
**Avitabile, J.,** *See* London, R.E., 3:21979
**Ayres, R.E.,** Environmental overview, 3:20910 (CONF-770658—, pp 87-98)
**Azizov, E.A.,** Power source of pumping system of a Q-switched solid-state laser, based on a multisection inductive storage device, 3:22655 (UCRL-Trans—11308)

## B

**Baarli, J.,** Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr—77-75)
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr—77-67)
**Baba, K.,** Studies of deep, widespread geothermal resources, 3:21409
**Babii, V.I.,** Nitrogen oxide formation in the fuel spray of a vortex burner burning a mixture of anthracite fines and sludge, 3:21527
**Baca, R.G.,** *See* Arnett, R.C., 3:22223
**Bacesa, L.,** *See* Heinzel, F., 3:22261
**Bachl, H.,** Combination of thermal power processes with a fuel conversion process, 3:21467
**Badertscher, N.L.,** Effects of fusion reactor size and availability on utility operations, 3:22558
**Bagus, P.S.,** *See* Bauschlicher, C.W. Jr., 3:21981
**Baikov, O.G.,** *See* Andreev, S.I., 3:22413
**Bailey, D.,** *See* Zimmerman, G., 3:22651
**Bailey, H.T.,** *See* Brocksen, R.W., 3:22275
**Bailey, L.L.,** Method and device for the conversion of heat into mechanical energy, 3:21851
**Bailey, S.C.,** Solar heating of the inaugural stand, 1977, 3:21338
**Baker, E.C.,** Synthetic, structural, and magnetic properties of the pyrazine-bridged lanthanide organometallic complex μ-pyrazine-bis[tris(cyclopentadienide)ytterbium (III)], $(C_5H_5)_3Yb(NC_4H_4N)Yb(C_5H_5)_3$, 3:21955
**Baker, E.G.,** *See* Aitken, J.H., 3:22167, 3:22186
**Baker, G.,** Strengths of building blocks containing shaped cavities for thermal insulation and rectification, 3:21777
**Baker, J.D.,** *See* Greenwood, R.C., 3:22360
**Baker, M.S.,** Typical Mathew Solar House: a three-year report, 3:21336
**Baker, R.N.,** *See* Smith, A.F., 3:21100
**Balalykin, N.I.,** *See* Ageev, A.I., 3:22107, 3:22108
**Balandikov, N.I.,** *See* Ageev, A.I., 3:22107
**Baldwin, D.E.,** Reassessment of the requirements to obtain field reversal in mirror machines, 3:22596 (UCID—17691)
**Baldwin, N.L.,** *See* Myers, B.F., 3:21572
**Balkowski, F.D.,** Comparison concerning thermal insulation installed at a later stage, 3:21791
**Ballam, J.,** Hybrid bubble chamber systems, 3:22126
**Ballantyne, S.B.,** *See* Cameron, E.N., 3:21129
**Baltisberger, R.J.,** *See* Ralston, D., 3:20881
**Baltrunas, D.A.J.,** *See* Alexandrov, A.J., 3:21239
**Bamberger, C.E.,** Hydrolysis of manganeous chloride, 3:21946
**Bammert, K.,** On heat transmission in radiation combustion chambers by heaters, 3:21516 (DOE-tr—30)
**Bampton, M.C.C.,** *See* Conn, R.W., 3:22560
**Banaschik, M.V.,** *See* Simon, R.S., 3:22369
**Bangs, E.R.,** Factors affecting the corrosion of fusion-welded joints in coal gasification systems, 3:20872
**Baranov, V.K.,** Concentration of diffuse radiation, 3:21372
**Baratov, D.G.,** Neutrino beam of the Institute of High-Energy Physics. III. System for shaping the proton beam for the external target, 3:22109
Neutrino beam of the Institute of High-Energy Physics. IV. Focusing device of the neutrino channel, 3:22110
Neutrino beam of the Institute of High-Energy Physics. I. General description and basic characteristics, 3:22116
**Barbaro-Galtieri, A.,** *See* Meyer, D.I., 3:22327
**Barker, D.L.,** *See* Loree, T.R., 3:22031
**Barkin, E.S.,** *See* Yakutseni, V.P., 3:20941
**Barnes, H.L.,** *See* Rimstidt, J.D., 3:21447
**Barnett, C.F.,** Status of the USA program on the development of submillimeter lasers to measure ion temperatures, 3:22419 (CONF-770954—5)
**Barr, W.L.,** *See* Moir, R.W., 3:22541, 3:22623
**Barrager, S.M.,** Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power, 3:21427 (SAN—115P108-1(Vol.2))
**Barrault, M.R.,** *See* Irie, M., 3:22435
**Barrington, H.L.,** *See* Enger, M.D., 3:22272
**Barse, J.R.,** Agriculture and energy use in the year 2000: discussion from a natural resource perspective, 3:21717
**Bartenev, V.,** *See* Akimov, Y., 3:22333
**Bartko, J.,** Method and apparatus for determining uranium concentration in a moving stream, 3:21933
**Barton, C.F.,** Computerized axial tomography for neutron radiography of nuclear fuel, 3:22075
**Barton, J.P.,** *See* Oien, C.T., 3:22074
**Bartsch, R.A.,** *See* Huffman, W.J., 3:21304
**Basham, I.R.,** Alpha-particle autoradiography of geological specimens by use of cellulose nitrate detectors, 3:21132
**Basina, Y.,** *See* Szomodyi, A., 3:22336
**Basov, N.G.,** Dynamics of stimulated emission from an electron-beam-

controlled $CO_2$ laser with a plasma mirror, 3:22044
Single-frequency GaAs injection laser, 3:22051
**Bass, R.R.,** Energy conversion alternatives study (ECAS), phase 2. Volume 3: research and development plans and implementation assessment. Final report, 3:21480 (N—77-26636)
**Basu, P.,** *See* Bhattacharya, K., 3:21288
**Bates, J.A.,** *See* Doran, J.C., 3:21460
**Bates, J.L.,** Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL—2004-6)
**Bates, M.R.,** Legal and institutional factors. Geothermal research study in the Salton Sea region of California, 3:21424
**Bates, R.C.,** Uranium mine radon control research, 3:21216
**Batistoni, D.A.,** *See* Feldman, C., 3:21929
**Batskan, B.,** *See* Szomodyi, A., 3:22336
**Battist, L.,** Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**Baucom, E.I.,** *See* Ferguson, R.B., 3:21119
**Bauer, T.S.,** *See* Blanpied, G.S., 3:22354
**Baulcomb, R.S.,** *See* Pion, M., 3:22059
**Baum, P.J.,** Conduction mode variation and inertial conductivity, 3:22498
**Baumann, G.,** *See* Gros, M., 3:22515
**Baumann, N.P.,** Operation of a nuclear test gauge at low multiplications, 3:21627
**Bauschlicher, C.W. Jr.,** Structure and energetics of simple carbenes $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$, 3:21981
**Bazarov, B.A.,** Investigating the geometric quality of cast polyurethane-foam duplicates for solar-energy concentrators, 3:21373
**Beachey, J.E.,** *See* Milne, T.A., 3:20928
**Beal, R.E.,** *See* Bangs, E.R., 3:20872
**Beall, G.W.,** Crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ and $Cd_3[Co(CN)_6]_2.12H_2O$ by neutron and x-ray diffraction, 3:21956
**Beatley, J.C.,** Endangered and threatened plant species of the Nevada Test Site, Ash Meadows, and central-southern Nevada, 3:22198 (COO—2307-13)
**Beauchamp, J.L.,** *See* Corderman, R.R., 3:21950
**Bechtold, R.L.,** Investigative study of engine limiting, 3:21860 (BERC/RI—77/13)
**Beck, B.B.,** *See* Britt, H.C., 3:22364
**Beck, L.S.,** Changing ideas on metallogenesis of Saskatchewan's uranium deposits, 3:21113
**Becka, J.,** Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress, 3:21874 (ZJE—186)
**Becker, D.,** *See* Narayana, P.A., 3:21993
**Becker, F.E.,** Development program for MHD power generation. Quarterly report, October 1976—December 1976, 3:21753 (FE—2015-21)
**Beecher, D.T.,** Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N—77-26628)
Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report, 3:21474 (N—77-26630)
**Beeson, J.L.,** *See* Duncan, D.A., 3:20875
**Begemann, S.H.A.,** Relative cost-performance of various solar-based power supply packages, 3:21298
**Begovich, C.L.,** *See* Alsmiller, R.G. Jr., 3:22192
**Behret, H.,** Vacuum-microgravimetric characterization of catalyst candidates for fuel cell electrodes, 3:21770
**Beltinger, T.L.,** Relative roles of conduction and convection in the body temperature change of gizzard shad, Dorosoma cepedianum, 3:22248
**Beketov, V.V.,** *See* Ageev, A.I., 3:22107, 3:22108
**Bekhman, I.M.,** Oil and gas separation on inclined shelves, 3:20969
**Belavin, V.A.,** *See* Andronov, G.A., 3:22047
**Belilovskii, Yu.B.,** *See* Temirbaev, D.Zh., 3:21494
**Belin, C.H.E.,** Homopolyatomic anions and configurational questions. Synthesis and structure of the nonagermanide(2-) and nonagermanide(4-) ions, $Ge_9^{2-}$ and $Ge_9^{4-}$, 3:21964
**Bell, M.J.,** Nuclear Regulatory Commission's Low-Level Waste Management Program, 3:21196
**Bell, W.E.,** *See* Myers, B.F., 3:21572
**Bellugue, J.,** General considerations concerning simple concentrators for photovoltaic cells, 3:21295
**Beloglazov, A.A.,** Experimental determination of the Hall parameter from the local characteristics of a MHD generator, 3:21768
**Belushkina, A.A.,** *See* Ageev, A.I., 3:22107
**Belykh, A.D.,** Investigation of a high-efficiency MHD generator with nonequilibrium conductivity, 3:21757
**Ben'kovskii, V.G.,** *See* Lobanova, G.A., 3:21047
**Bender, D.J.,** Mirror hybrid (fusion—fission) reactor, 3:22542 (UCRL—80076)
**Benedetti, D.,** Problem of foundation-structure interaction in large dams and other massive systems, 3:21265
**Benedict, U.,** Study of uranium-plutonium carbide-based fuel simulating high burnup, 3:21150
**Benefield, B.D.,** *See* Wyatt, W.B. Jr., 3:21774
**Benemann, J.R.,** Cultivation on sewage of microalgae harvestable by microstrainers. Progress report, 3:21311 (TID—27702)
**Benndorf, H.,** Energy and information transmission in 20 kV medium-voltage systems using the phase-wire cable system, 3:21534
**Bennett, A.G.,** Digital RLC analysis of CDU fireset x-units, 3:22138 (BDX—613-1945)
**Bennett, R.J.,** *See* Johnson, D.H., 3:21673
**Benton, E.V.,** *See* Frank, A.L., 3:22165
**Berdiev, M.G.,** Designing evaporative thermal siphons for use in thermoelectric devices, 3:22070
**Berdnikova, A.V.,** Migration of uranium from the environment into a human being, 3:22279 (ORNL-tr—4551)
**Beretvas, A.,** *See* Auer, I.P., 3:22335
*See* Hidaka, H., 3:22342
**Berk, H.L.,** Variational method for electromagnetic waves in a magneto-plasma, 3:22494
**Berkner, K.H.,** Performance of a developmental 120-keV, 10-A deuterium (14-A hydrogen) neutral beam system, 3:22619 (LBL—6384)
**Berkowitz, J.,** *See* Kronebusch, P.L., 3:21991
**Berkowitz, J.B.,** Feasibility investigations of growing and characterizing gallium arsenide crystals in ribbon form. Semi-annual progress report 1 January—30 June 1975, 3:21280 (PB—269587)
**Berkowitz, M.,** Performance, emissions, and physical characteristics of a rotating combustion aircraft engine, 3:21854 (N—77-26134)
**Berman, L.D.,** Effect of heated water discharge on oxygen content in the water supply source of thermal power plants, 3:21523
**Bernal, I.,** *See* Beall, G.W., 3:21956
**Bernath, L.,** Sundesert reliability engineering, 3:21570
**Berreth, J.R.,** *See* Schindler, R.E., 3:21170
**Berry, H.G.,** Measurement of the Stokes parameters of light, 3:22130
**Bers, A.,** *See* Pereira, N.R., 3:22486
**Bertini, H.W.,** *See* Alsmiller, R.G. Jr., 3:22192
**Bertland, H.,** *See* Claesson, A., 3:21055
**Bertotti, B.,** Conversion of laser radiation into x-rays in the subnanosecond region, 3:22656
**Bertram, R.E.,** *See* Watkins, R.A., 3:22012
**Bertrand, P.,** *See* Gros, M., 3:22515
**Berwald, D.H.,** Neutronic analysis of a laser-fusion-driven actinide waste burner, 3:22634
**Besant, R.W.,** Design of a solar heated energy conservation house for western Canada, 3:21352
**Bessho, Y.,** *See* Nishihara, H., 3:21591
**Bessler, D.U.,** Distillate fuel containing dehazing compositions, 3:20996
**Besson, B.,** *See* Murat, M., 3:21853
**Best, R.W.B.,** Clean fusion concepts and efforts: a survey, 3:22546
**Bettis, E.S.,** *See* Uckan, N.A., 3:22537
**Betz, A.L.,** *See* Sutton, E.C., 3:22295
**Beyaert, B.,** Analysis of oil spill accidents for environmental impact statements, 3:21025
**Bhattacharya, K.,** Back wall Schottky barrier solar cell with an interfacial layer, 3:21288
**Bianchi, M.,** *See* Baarli, J., 3:22253, 3:22262
**Bibikov, G.G.,** Disposal of petroleum sludges, 3:21017
**Biederman, N.,** *See* Yudow, B., 3:21326
**Bienstock, D.,** Pittsburgh Energy Research Center (PERC) combustion support program, 3:20926 (CONF-770658—, pp 69-86)
**Bierney, T.K.,** Instrumentation for the measurement of vibration in severe environments, such as nuclear reactors, 3:21612
**Bigeleisen, J.,** New advances in isotope separation, 3:21140 (COO—3498-30)
**Bighel, L.,** Heating and ionization in MHD switch-on shocks in partially ionized plasmas, 3:22408
**Bikbulatov, N.Z.,** *See* Baratov, D.G., 3:22110
**Bilger, G.,** *See* Schock, H.W., 3:21287
**Binder, H.,** *See* Behret, H., 3:21770
**Bini, M.,** *See* Gelbke, C.K., 3:22374
**Birk, J.R.,** High temperature battery requirements put ceramics through their paces, 3:21676
**Birns, K.F.,** Determination of an oil effluent guideline for industrial discharges in the state of New Jersey: is 1 ppM realistic and obtainable, 3:21026
**Biscaye, P.E.,** Suspended particulates and natural radionuclides as tracers of pollutant transports in Continental Shelf waters of the Eastern U.S.A., 3:22215 (TID—22790)
**Bischel, W.K.,** *See* Prosnitz, D., 3:22028
**Bischofberger, T.,** Transient behavior of a nonlinear Fabry-Perot, 3:22029
**Bishop, B.L.,** *See* Gabriel, T.A., 3:22386
**Biter, W.J.,** *See* Shirland, F.A., 3:21282
**Blachly, C.H.,** *See* Deitz, V.R., 3:21176
**Black, A.D.,** Full-scale laboratory drilling tests on sandstone and dolomite. Final report, 3:20952 (COO/4098—1)
**Blagodarnaya, L.F.,** Treatment of waste streams from catalyst manufacturing plants in refineries, 3:21015
**Blais, N.C.,** *See* Truhlar, D.G., 3:21954
**Blake, D.O.,** *See* Bliss, C., 3:21309

**Blake, T.R.,** Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977—March 31, 1977, 3:20854 (FE—1770-26)
**Blanchot, P.,** *See* Aureille, R., 3:21526
**Blanco, R.E.,** *See* Witherspoon, J.P., 3:21206
**Blankenbecler, R.,** Possible connections between hard and soft processes, 3:22347 (SLAC-PUB—2051)
Relativistic interactions between nuclei, coherence effects and nonscaling, 3:22381 (SLAC-PUB—2010)
**Blann, M.,** *See* Britt, H.C., 3:22364
**Blanpied, G.S.,** Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$, 3:22354
**Blattman, H.,** Effect of pions on the embryonal development of the mouse, 3:22263 (LA-tr—77-77B)
*See* Heinzel, F., 3:22261
**Blauvelt, R.K.,** *See* Watkins, R.A., 3:22012
**Blink, J.A.,** Energy partition and neutron spectra from laser fusion reactor targets, 3:22675
Laser fusion deployment scenario, 3:22660
**Bliss, C.,** Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR—7347(Vol.5))
**Bliss, E.S.,** Automatic alignment system for the twenty beam shiva fusion laser, 3:22652 (UCRL—80249)
**Bloomster, C.H.,** *See* Conn, R.W., 3:22560
**Bloss, W.H.,** *See* Schock, H.W., 3:21287
**Blum, A.S.,** *See* Moir, R.W., 3:22623
**Blume, J.A.,** Special considerations for seismically active areas, 3:21669
**Bobin, J.J.,** Raman scattering and two-plasmon instability in laser-created plasmas, 3:22530
**Boblitz, O.W.,** Methane gas process and apparatus, 3:21260
**Bobrov, D.M.,** *See* Surkov, Yu.V., 3:21082
**Bobrovskii, G.A.,** *See* Alikaev, V.V., 3:22453
**Bock, R.S.,** 1977 guidebook to California taxes with special emphasis on relationship to Federal taxes, 3:21687
**Bodan, A.N.,** *See* Primak, R.G., 3:21048
**Bodeau, D.J.,** *See* Murarka, I.P., 3:22210
**Bodmer, M.,** Chemistry of feedwater for boiling-water and pressurized-water reactors, 3:21558
**Boehl, J.E.,** *See* Bostick, F.X., 3:21405
**Boehm, F.,** *See* Yamazaki, T., 3:22318
**Boehmer, V.,** *See* Appel, H., 3:22111
**Boes, E.C.,** Estimating monthly means of daily totals of direct normal solar radiation and of total solar radiation on a south-facing, 45°, tilted surface, 3:21268 (SAND—77-0874)
**Bogdan, S.N.,** *See* Gordon, B.G., 3:21660
**Bogdanov, M.V.,** *See* Primak, R.G., 3:21048
**Bogdanovic, M.,** *See* Antic, S., 3:21004
**Bogner, J.E.,** Environmental control technology program studies at Argonne National Laboratory: surface mine effluents, 3:20911 (CONF-7710101—4)
**Bogopol'skii, V.O.,** *See* Chubanov, O.V., 3:20967
**Bohachevsky, I.O.,** Scaling of reactor cavity wall loads and stresses, 3:22638 (LA—7014-MS)
Scaling of reactor cavity wall loads and stresses, 3:22674
Thermonuclear fusion device LIME, 3:22568
*See* Booth, L.A., 3:22661
**Bohne, R.M.,** *See* Job, C.A., 3:21684
**Boidron, M.,** *See* Marbach, G., 3:21892
**Boiko, A.V.,** Method of optimal design of axial turbine stages, 3:21491
**Boiko, L.V.,** *See* Zrelov, V.N., 3:21050
**Boiko, V.A.,** *See* Basov, N.G., 3:22044
**Boitsova, E.A.,** *See* Rzheznikov, Yu.V., 3:21506
**Boivin, J.C.,** Solid phases of the $Bi_2O_3$—PbO system: identification and evolution as a function of temperature, 3:21900 (SAND—77-6024)
**Bokhan, P.A.,** Investigation of the energy characteristics of a copper vapor laser with a longitudinal discharge, 3:22050
**Bol'shov, L.A.,** Lagrangian description of flute drift turbulence of $\theta$-pinch plasma, 3:22411
**Boldeman, J.W.,** *See* Musgrove, A.R.L., 3:22366
**Boldt, E.,** *See* Swank, J., 3:22296
**Bolger, J.E.,** *See* Morris, C.L., 3:22355
**Bolkovyskii, E.V.,** *See* Ageev, A.I., 3:22108
**Bollinger, H.,** Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr—277)
**Bolton, W.R.,** Hybrid trajectory simulation of the B77 system, 3:22140 (SAND—77-8040)
**Bomar, S.H. Jr.,** *See* Walton, J.D. Jr., 3:21317
**Bond, W.H.,** *See* Luthy, D.F., 3:21172
**Bondarenko, N.F.,** *See* Pertrosyan, V.I., 3:21888
**Bondarenko, V.I.,** *See* Koval', V.P., 3:22088
**Bondietti, E.A.,** *See* Jackson, D.R., 3:21930
**Boody, F.P.,** NPL-NS: a "Next Step" experiment for inertial confinement fusion, 3:22636 (COO—2007-92)
*See* Prelas, M.A., 3:22673
**Booth, L.A.,** Characterization of laser fusion reactor concepts, 3:22663
Fusion energy applied to synthetic fuel production: a report to the DOE Division of Magnetic Fusion Energy based on a preliminary study by an ad-hoc advisory group, 3:21243 (CONF-770593—)
Requirements for commercialization of inertial confinement fusion, 3:22661
**Boozer, D.D.,** Insider safeguards effectiveness model (ISEM). User's guide, 3:21221 (SAND—77-0043)
**Boquist, C.W.,** Magnetohydrodynamic electrode, 3:21762
**Boranic, V.,** *See* Antic, S., 3:21004
**Borblik, E.L.,** Investigation of the combustion chamber of an experimental MHD generator and some problems of updating, 3:21763
**Borgstedt, H.U.,** Corrosion resistance of vanadium and vanadium alloys as structural materials in a lithium cooled fusion reactor, 3:21893
**Borgstedt, K.E.,** Concept of large power plants fired with bituminous coal, 3:21463
Design concept of large coal-fired power plants, 3:21465
**Borisevich, B.D.,** *See* Ogorodnikov, P.I., 3:20963
**Borisov, B.N.,** Neodymium-glass disk amplifier, 3:22049
**Borka, S.,** Peak effect in type II superconductors, 3:21875
Vortex-pinning forces in superconducting niobium-zirconium alloys with low j/sub c/, 3:21889
**Bortnikov, A.V.,** Design and physical principles of the finger-ring T-12 Tokamak with two axisymmetrical diverters, 3:22555 (ORNL-tr—4530)
**Bostick, F.X.,** Magnetotelluric measurements over Kilauea Iki lava lake, 3:21405
**Botts, T.,** *See* Majumdar, D., 3:22632
**Boudet, E.,** Note on underground coal gasification, 3:20873
**Boudrie, R.L.,** *See* Morris, C.L., 3:22355
**Bourham, M.A.,** *See* El-Khalafawy, T.A., 3:22514
**Bouteau, F.,** Calculational tool for neutron propagation in steel and sodium media for fast reactor shielding applications, 3:22389
**Bouwer, E.J.,** Uranium assay of phosphate fertilizers and other phosphatic materials, 3:21941
**Bowen, V.T.,** Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976—September 30, 1977, 3:22220 (COO—3568-18)
**Bowman, H.,** Nuclear techniques in geochemical studies of hydrothermal systems, 3:21412
**Bowring, R.,** *See* Idsinga, W., 3:21559
**Boyarchuk, A.F.,** *See* Nechai, A.M., 3:20946
**Boyarski, A.M.,** *See* Meyer, D.I., 3:22327
*See* Perl, M.L., 3:22328
**Boyd, J.K.,** Diagnostic programs used with McGUS a 3D mirror equilibrium code, 3:22422 (UCID—17650)
**Boyle, M.J.,** Long pulse microsphere experiments at 3 TW, 3:22646 (UCRL—79779)
**Boyle, R.J.,** Evaluation of initial collector field performance at the Langley Solar Building Test Facility, 3:21370 (N—77-26617)
**Bozorgmanesh, H.,** *See* Reynolds, G.M., 3:21922
**Bradley, R.F.,** Low-pressure hydraulic technique for slurrying radioactive sludges in waste tanks, 3:21165 (DP—1468)
**Braekman-Danheux, C.,** Study of the pyrolysis of toluene and phenols at low pressure, 3:20896
**Braeunlich, G.,** Heat recovery from domestic waste water, 3:21792
**Braithwaite, W.J.,** *See* Morris, C.L., 3:22355
**Brajcic, V.,** *See* Antic, S., 3:21004
**Bramson, P.E.,** *See* Fix, J.J., 3:22207
**Brandon, J.R.,** *See* Sivinski, H.D., 3:21240
**Bratenahl, A.,** *See* Baum, P.J., 3:22498
**Breidenbach, M.,** Properties of the psi resonances, 3:22339 (SLAC-PUB—1602)
*See* Perl, M.L., 3:22328
**Breitkopf, G.,** Possibilities of early detection of failures in steam turbines by evaluating the temperature transmitting behavior of component groups and its correlation with defective variations, 3:21486 (NP—22768)
**Brenchley, D.L.,** Environmental assessment methodology for the nuclear fuel cycle, 3:21205
**Brennan, J.A.,** Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October—December 1976, 3:21257 (FE—2276-6)
**Brennan, M.H.,** Determination of plasma density and temperature profiles using magneto-acoustic oscillations, 3:22436
Nuclear fusion: the energy source for the future, 3:22552
**Breslin, A.J.,** Methods used by HASL for ambient radon studies, 3:22166 (HASL—325, pp 9-16)
Radon workshop, February 1977, 3:22163 (HASL—325)
**Bretschneider, C.L.,** OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available, 3:21327 (SAN—235P13-39(Vol.1))
**Breun, R.,** *See* Wong, A.Y., 3:22565
**Brevnov, N.N.,** *See* Bortnikov, A.V., 3:22555
**Brickhill, J.A.,** Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB—269365)

Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB—269366)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS, 3:21815 (PB—269367)
**Briegel, U.,** *See* Mueller, W.H., 3:21195
**Brikker, S.,** *See* Szomodyi, A., 3:22336
**Brissot, J.,** Silicon for solar cells, 3:21292
**Bristow, T.C.,** *See* Yaakobi, B., 3:22440
**Britt, H.C.,** Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**Brocksen, R.W.,** Respiratory response of juvenile chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil, 3:22275 (CONF-730386—, pp 783-791)
**Brodda, B.G.,** Remotely controlled computer-guided preparation facility for X-ray fluorescence measurement samples at a fuel reprocessing plant, 3:21156
**Brodsky, S.J.,** Composite models of hadrons and large transverse processes, 3:22340
**Brody, P.S.,** High voltage particle accelerator utilizing polycrystalline ferroelectric ceramic material, 3:22102
**Brody, T.P.,** *See* Shirland, F.A., 3:21282
**Bronnikov, V.K.,** Influence of charge moisture contents on carbonization periods, 3:20845
**Brooks, J.N.,** Resistive requirements for the vacuum wall of a Tokamak Fusion Reactor, 3:22676 (CONF-771029—182)
*See* Stacey, W.M. Jr., 3:22535
**Brooks, K.M.,** Pinhole imaging of laser-produced thermonuclear alpha particles, 3:22424 (UCRL—79780)
*See* Boyle, M.J., 3:22646
**Brooks, R.D.,** Coal fired combined cycle for electric power generation, 3:21482 (TID—27939)
**Brooman, E.W.,** *See* Sulzberger, V.T., 3:21521
**Broschk, J.,** Possibilities of solar space heating, 3:21328 (AED-Conf—1977-053-004)
**Brown, A. Jr.,** General Motors powdered coal-oil project, 3:20925 (CONF-770658—, pp 29-52)
**Brown, B.C.,** *See* Kephart, R.D., 3:22334
**Brown, C.L.,** *See* Clayton, E.D., 3:21215
**Brown, C.N.,** *See* Kephart, R.D., 3:22334
**Brown, C.T.,** *See* Walton, J.D. Jr., 3:21317
**Brown, D.H.,** Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report, 3:21477 (N—77-26633)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems: conceptual designs. Part 4: summary of results. Final report, 3:21479 (N—77-26635)
*See* Bass, R.R., 3:21480
**Brown, D.J.,** *See* Arnett, R.C., 3:22223
**Brown, F.R.,** Raman spectra of supported molybdena catalysts. II. Sulfided, used, and regenerated catalysts, 3:20846
**Brown, G.J.,** *See* Martin, J.G., 3:22574
**Brown, G.M.,** Tripotassium hydroxylaminetrisulfonate sesquihydrate, neutron data, 3:21968
**Brown, M.C.,** Intense neutron source facility. Progress report, July 1—September 30, 1977, 3:22096 (LA—7023-PR)
**Brown, R.,** 10.6 μm interferometry and Faraday rotation measurements on a theta-pinch plasma, 3:22433
**Brown, R.A.,** *See* Pancirov, R.J., 3:21052
**Brown, R.D.,** Review of environmental issues of the transportation of Alaskan North Slope crude oil. Final report, 3:21730 (PB—270088)
**Brown, W.M.,** 100,000 quads of natural gas, 3:21061 (HI—2451/3-P)
Suggestions for a Phase-II national energy policy. Final report, March 1977—September 1977, 3:21723 (FE/2660—1)
**Brownlie, T.J.,** *See* Pearce, D.L., 3:21075
**Brudnyi, V.N.,** Electrical and recombination characteristics of Cd/sub x/Hg/sub 1-x/Te irradiated with electrons at T=300° K, 3:21897
**Brueck, S.R.J.,** *See* Kildal, H., 3:22019, 3:22032, 3:22637
**Brumbach, S.B.,** Autoradiographic techniques for rapid inventory of reactor fuel, 3:21235
**Bruns, L.E.,** *See* Untermyer, S., 3:22202
**Brusati, M.,** Ion energy balance in ohmically heated PLT discharges, 3:22449 (PPPL—1403)
**Brusse, L.A.,** *See* Franck, J.V., 3:22602
**Bryukhnevich, G.I.,** High-speed image converters for studying laser radiation with picosecond and femtosecond time resolution, 3:22431 (UCRL-Trans—11298)
**Bube, R.H.,** *See* Haines, W.G., 3:21903
**Buch, A.,** Is the development of large power plant units reasonable, 3:21520
Is the trend of building giant units of power plants justified, 3:21466
**Buck, J.V.,** Regulatory, planning and policy aspects of geothermal energy development in Imperial County, California, 3:21415
**Buckner, M.R.,** Jeremiah Environmental Computational System, 3:22194
**Budneva, O.B.,** Some models of wave collapses, 3:22531
**Buechе, B.,** *See* Appel, H., 3:22111
**Buehl, W.M.,** *See* Ortabasi, U., 3:21376
**Buening, H.J.,** *See* Hunter, S.C., 3:22092
**Bugorskii, A.P.,** *See* Baratov, D.G., 3:22116
**Bulaevskii, L.N.,** Influence of lattice defects and localized magnetic moments on the Josephson current in layered composites, 3:21909
**Bull, S.R.,** *See* Castagno, J.G., 3:22073
**Burch, D.M.,** Retrofitting an existing wood frame residence for energy conservation: an experimental study. Final report, 3:21785 (PB—269847)
*See* Rossiter, W.J. Jr, 3:21773
**Burki, H.J.,** Critical DNA damage and mammalian cell reproduction, 3:22251
**Burnette, R.D.,** *See* Myers, B.F., 3:21572
**Burnham, R.D.,** Discrete and distributed feedback buried heterostructure lasers, 3:22062
**Burolla, V.P.,** Analysis of thermally degraded sensible heat storage hydrocarbons, 3:21384 (SAND—77-8264)
**Burrell, C.F.,** Calorimetric and optical beam diagnostics on the LBL 120-keV neutral beam test facility, 3:22618 (LBL—6383)
**Burrell, D.C.,** Review of the chemical speciation of copper in seawater, 3:22214 (RLO/2229/T1—41)
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976—May 31, 1977, 3:22286 (RLO/2229/T1—40)
**Burrows, T.W.,** Reference nuclear data for space technology, 3:22290
**Burt, O.R.,** Defining upper limits to groundwater development in the arid West, 3:21694
**Buschbom, R.L.,** *See* Wehner, A.P., 3:22277
**Bush, A.W.,** *See* Gibson, R.D., 3:22069
**Bush, C.E.,** Wall power measurements of impurity radiation in ORMAK, 3:22579 (ORNL/TM—6148)
**Bush, W.A.,** Report of survey of valve industry capabilities, 3:20849 (CONF-771145—2)
**Bushey, W.R.,** Trans effects in octahedral complexes: substitution of chloromethyl- and dichloromethylpentaaquochromium(III) ions by thiocyanate ion, 3:21957
**Bussard, R.W.,** X-ray and gamma-ray line production by nonthermal ions, 3:22297 (N—77-27061)
**Butler, E.,** *See* Pick, J.B., 3:21416
**Butler, H.S.,** *See* Perry, D.G., 3:22118
**Butovskii, L.S.,** *See* Borblik, E.L., 3:21763
**Butter, C.D.,** *See* Zook, J.D., 3:21273
**Butterfield, K.B.,** *See* Loree, T.R., 3:22031
**Buyanova, N.S.,** *See* Lobanova, G.A., 3:21047
**Buyers, W.J.L.,** Uranium nitride: a cubic antiferromagnet with anisotropic critical behavior, 3:21901 (CONF-771080—2)
**Bychkov, N.S.,** *See* Ageev, A.I., 3:22107, 3:22108
**Byers, J.A.,** Computer simulation of field reversal in mirror machines, 3:22598

## C

**Cabral, J.A.C.,** K-spectrum analysis of the nonlinear time development of the electron cyclotron instability, 3:22489
**Cadiou, L.,** Metallurgical evolution of heavy forgings in low alloys steels for nuclear vessels, 3:21564
**Caffey, T.W.H.,** Locating a buried earth penetrator, 3:22001 (SAND—77-0646)
**Cahill, R.A.,** *See* Ruch, R.R., 3:21919
**Caines, P.E.,** Application of the statistical theory of feedback to power system identification, 3:21540
**Calais, D.,** *See* Marbach, G., 3:21892
**Calef, C.E.,** *See* Drysdale, F.R., 3:21677
**Callahan, W.M.,** *See* Johnston, W.D. Jr., 3:21300
**Callen, J.D.,** *See* Peng, Y-K.M., 3:22561
**Calmon, C.,** Containment and removal of radioactive spills by depositing a crosslinked ion exchange composition in a dry form over region of spill, 3:21213
**Calvin, K.,** *See* Mei, H., 3:21355
**Cameli, G.M.,** *See* Albo, M., 3:21404
**Cameron, E.M.,** Reconnaissance-level geochemical and radiometric exploration data from the vicinity of the Rabbit Lake uranium deposit, 3:21129
**Cameron, P.J.,** *See* Symonds, P.A., 3:22284
**Camp, D.,** *See* Kaufman, L., 3:21939
**Campbell, E.W.,** *See* Enger, M.D., 3:22272
**Campbell, J.H.,** *See* Coburn, T.T., 3:21105
**Campbell, R.W.,** RTG radiation and its effect on spacecraft instrumentation, 3:22128
**Campen, G.L.,** ORMAK upgrade ohmic coil generator protection, 3:22603 (ORNL/TM—6079)
**Cannon, W.C.,** *See* Wehner, A.P., 3:22277
**Capano, L.,** *See* Eckart, L.E., 3:22196
**Capasso, A.,** Voltage and reactive production programming in an electric system. II. Notes on mathematical models of generators and loads, 3:21511
**Carbajo, J.J.,** Experience with team-teaching at the University of Illinois, 3:21604

**Cardwell, R.G.,** Recent developments and accomplishments in safeguards education and standards for the control of nuclear materials, 3:21223
**Carlitz, R.D.,** Why the neutron isn't all neutral, 3:22329
**Carlson, G.A.,** *See* Moir, R.W., 3:22541
**Carlson, N.G.,** Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan, 3:21485 (FE—2292-9)
**Carlson, R.G.,** *See* Stabrylla, R.G., 3:21907
**Carlson, R.W.,** *See* Webb, W.E. Jr., 3:21163
**Carnall, W.T.,** *See* Jacobs, R.R., 3:21965
**Carnegie, R.K.,** $Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications, 3:22351
**Carpenter, B.S.,** Uranium analysis of natural waters by fission tracks, 3:21926
**Carpenter, R.J.,** *See* Moore, R.T., 3:21219
**Carrales, M. Jr,** Liquid hydrocarbon production in the United States, 1946-75 and 1980 projected, highlighting enhanced recovery. Information circular, 3:20958 (PB—269951)
**Carroll, T.O.,** Energy information and analytic system for New York State, 3:21679 (BNL—22677)
**Carrus, A.,** *See* Capasso, A., 3:21511
**Casey, E.J.,** Towards long-lived satellites, 3:21674
**Cashmore, R.J.,** *See* Carnegie, R.K., 3:22351
**Cassel, T.A.V.,** *See* Corman, J.C., 3:21476
**Cassou, R.,** *See* Frank, A.L., 3:22165
**Castagno, J.G.,** Contrast reduction factor for object contrast assessment in neutron radiography, 3:22073
**Castillo, R.,** Advanced fuel nuclear reaction feasibility using laser compression. II, 3:22657
**Castor, J.,** *See* Weaver, R., 3:22301
**Cataldi, R.,** *See* Albo, M., 3:21404
**Catelin, D.,** *See* Rabbe, P., 3:21565
**Catron, H.C.,** *See* Tirsell, K.G., 3:22653, 3:22654
**Catto, P.J.,** Adiabatic modifications to plasma turbulence theories, 3:22510
Model of the Rayleigh-Taylor stability of an ablating fluid, 3:22479
**Catton, I.,** Suppression pool dynamics. Quarterly progress report, April 1—June 30, 1977, 3:21642 (NUREG—0264-4)
**Caumette, P.,** *See* Bouteau, F., 3:22389
**Cavallo, J.,** Transition to decentralized energy systems, 3:21739 (CONF-7710101—1)
**Ceglio, N.M.,** *See* Brooks, K.M., 3:22424
**Cermak, V.,** High heat flow measured in Ostrova-Karvina coal basin, 3:21454
Terrestrial heat flow in two deep holes in the Ostrova-Karvina coal basin, 3:21410
**Cerny, J.,** Delayed proton radioactivities, 3:22384
**Chadraa, B.,** *See* Szomodyi, A., 3:22336
**Chalmers, J.H.,** *See* Clayton, E.D., 3:21215
**Chan, C.K.,** *See* Catton, I., 3:21642
**Chan, G.L.,** Study of the effects of the San Francisco oil spill on marine organisms, 3:22269 (CONF-730386—, pp 741-781)
**Chan, L.D.,** *See* Kerimov, A.A., 3:20943
**Chandra, S.,** Appropriate plumbing for open solar water heaters, 3:21364
**Chang, J.,** *See* Leeper, R.J., 3:22641
**Chang, K.H.,** *See* Chuang, A.S., 3:21583
**Channon, S.R.,** Methods of 'tailoring' ion distributions in phase space ('morphodynamics'), 3:22445
**Chappelear, P.S.,** Evaluation of thermophysical property correlations, 3:21064 (CONF-770375—, pp 1-10)
**Charak, I.,** Temperature distributions in fusion reactor first-wall systems, 3:22590
*See* Smith, D.L., 3:22577
**Charlet, J.M.,** Prospects for uranium exploration on a national scale, 3:21133
**Charlton, L.A.,** *See* Managoli, V., 3:22371
**Chatfield, R.,** *See* Rasmussen, R.A., 3:22145
**Chatterjee, R.M.,** *See* Aitken, J.H., 3:22186
**Chebotayev, V.P.,** *See* Gusev, Yu.L., 3:22039
**Cheishvili, O.D.,** Effect of electron-phonon scattering on collective excitations in "dirty" superconductors, 3:22396
**Chen, C.K.,** Analysis of bunching of an electron beam at optical wavelengths, 3:22313
**Chen, J.C.,** Use of fluidized bed heat exchangers in heat pump systems for improved performance. Technical status report, September 1, 1977—November 31, 1977, 3:21772 (COO/4490—1)
**Chen, R.J.J.,** *See* Chappelear, P.S., 3:21064
**Cheney, J.L.,** Present relationships of sulfuric acid concentration to acid dewpoint for flue gases, 3:20905
**Cheng, C.Z.,** Theory and numerical simulations on collisionless drift instabilities in three dimensions, 3:22477 (PPPL—1397)
*See* Okuda, H., 3:22457
**Cheng, E.T.,** *See* Abdel-Khalik, S.I., 3:22668
**Cheng, F.T.,** Equation of polarization transfer in an inhomogeneous magnetized plasma. I. Formalism, 3:22525
New approach of studying electromagnetic mode coupling in inhomogeneous magnetized plasma. I. Normal incidence, 3:22524
**Chenzbraun, I.,** Fast-tripping operation of the coupling bay protection in case of faults in the immediate vicinity of the busbars, 3:21536
**Cherednichenko, G.I.,** *See* Kostyuk, V.I., 3:21016
**Cheremukhov, B.V.,** *See* Dyatlov, V.D., 3:22121
**Chernov, V.A.,** *See* Baratov, D.G., 3:22110
**Cheron, J.,** Fuel cell, 3:21769
**Cherry, J.M.,** *See* Bretschneider, C.L., 3:21327
**Chertkova, N.Ya.,** *See* Gureev, A.A., 3:21059
**Chetverikova, G.A.,** *See* Gerasimova, E.M., 3:21290
**Cheverton, R.D.,** Thermal shock studies associated with injection of emergency core coolant following a loss-of-coolant accident in PWRs, 3:21651
**Chick, S.W.K.,** Hydrospheric trace elements and their application in tracing water pollutants, 3:22217
**Chikova, L.,** *See* Szomodyi, A., 3:22336
**Chilcoat, M.,** *See* Reid, R.L., 3:21379
**Childers, E.E.,** *See* Lamey, S.C., 3:21102
**Chin, J.S.,** *See* Blink, J.A., 3:22660
**Chin, R.,** *See* Coleman, J.J., 3:22064
**Ching, J.T.,** Development of a nuclear engineering computer code workshop, 3:21607
**Chinowsky, W.,** Psionic matter, 3:22349
*See* Perl, M.L., 3:22328
**Chiou, H.H.,** *See* Catton, I., 3:21642
**Chitre, S.,** *See* Jones, G.T., 3:21277
**Chiu, S.Y.,** *See* Habegger, L.J., 3:21740
**Chmel, V.N.,** *See* Borblik, E.L., 3:21763
**Choban, E.A.,** Production of charmed particles in weak interactions with diagonal neutral currents, 3:22345
**Choi, C.,** *See* Miley, G.H., 3:22624
**Choi, C.K.,** *See* Boody, F.P., 3:22636
**Choppin, G.R.,** Studies of the hydrogen bonded structures of water and methanol, 3:21948 (ORO—1797-76)
*See* Hasegawa, Y., 3:21961
*See* Kullberg, L., 3:21960
**Chorin, A.J.,** Computational aspects of Glimm's method, 3:22000 (LBL—7228)
**Chou, T.T.,** High energy hadron—hadron collisions. Annual progress report, 3:22348 (SRO—946-1)
**Choudhury, A.,** Pipeline for transportation of solids: a reality, 3:22014
**Chouet, B.,** Mapping a magma reservoir by locating thermal cracks, 3:21407
**Choy, Y.C.,** *See* Glassey, C.R., 3:21222
**Christensen, D.L.,** Solar heating and cooling technical data and systems analysis. Progress report, October 1974—30 April 1977, 3:21330 (N—77-26611)
**Christensen, G.S.,** *See* Nieva, R., 3:21617
**Christensen, O.,** *See* Britt, H.C., 3:22364
**Christianson, F.,** *See* Williams, J.R., 3:21707
**Christie, R.S.,** Low-noise control valve. II, 3:22607 (CONF-771029—153)
**Christie, W.H.,** *See* Young, R.T., 3:21912
**Christoffersen, R.E.,** Stereoelectronic properties of aggregate chlorophyll systems. Progress report, January 1—December 31, 1977, 3:21975 (COO—2837-3)
**Chriswell, C.D.,** Selective concentration of amines from aqueous solutions by a gas purging technique, 3:21945
**Chu, T.K.,** *See* Schuss, J.J., 3:22420
**Chuang, A.S.,** Static test of the gas-cooled fast breeder reactor core support grid plate: comparison of experimental, analytical, and finite-element models, 3:21583 (GA-A—14121)
**Chubanov, O.V.,** Selection of objects for exerting an effect on bottom hole zone, given a great number of dependent characteristics, 3:20967
**Chugunov, A.Y.,** *See* Basov, N.G., 3:22044
**Chun, K.S.,** Studies on the thermal decomposition of nitrates found in highly active waste and of chemicals used to convert the waste to glass, 3:21168 (AERE-R—8735)
**Churchill, R.J.,** Photomicrograph techniques for characterization and monitoring oily waste streams, 3:21033
**Ciramella, A.F.,** *See* Seabaugh, P.W., 3:21232
**Cisar, A.,** *See* Belin, C.H.E., 3:21964
**Citron, O.R.,** Institutional and environmental aspects of geothermal energy development, 3:21414
**Claesson, A.,** Underground storage of oil and gas, 3:21055
**Clardy, J.,** *See* Fenical, W., 3:22240
*See* Prestwich, G.D., 3:21980
**Claridge, D.E.,** Environmental radioactivity from hospitals, 3:22226
**Clark, D.,** Coal gasification and South Africa, 3:20865
**Clark, G.A.,** Cancel 60 Hz and other noise, 3:22081
**Clark, G.J.,** *See* Young, R.T., 3:21912
**Clark, H.K.,** *See* Clayton, E.D., 3:21215
**Clark, R.C. Jr.,** Interagency investigations of a persistent oil spill on the Washington Coast, 3:22270 (CONF-730386—, pp 793-808)
**Clark, S.J.,** Energy policy and research: discussion from the ERDA perspective, 3:21699
**Clarke, D.K.,** Coal gasification: when, 3:20851 (CONF-7603113—, pp C1-C18)
**Classen-Nekludowa, M.,** Stepwise deformation, 3:22393 (UCRL-Trans—11291)

**Clausing, A.M.,** Solar collector cost reduction with reflector enhancement, 3:21382
**Clayton, E.D.,** Basis for subcritical limits in proposed criticality safety standard for mixed oxides, 3:21215
**Clemens, R.H.,** *See* Job, C.A., 3:21684
**Cleveland, E.B.,** *See* Long, R.L., 3:21555
**Clewley, J.D.,** *See* Tanaka, S., 3:21254
**Cliff, W.C.,** Effect of generalized wind characteristics on annual power estimates from wind turbine generators, 3:21459 (PNL—2436)
**Clifford, J.E.,** *See* Sulzberger, V.T., 3:21521
**Cloth, P.,** *See* Kuijpers, L., 3:22581
**Cobarg, C.C.,** Solar energy for everybody. Solar cells, solar collectors with instructions for own experiments, 3:21272
**Cobet, A.B.,** Effect of a bunker fuel on the beach bacterial flora, 3:22273 (CONF-730386—, pp 815-819)
*See* Guard, H.E., 3:22211
**Coburn, T.T.,** Oil shale retorting: Part 2, variation in product oil chemistry during retorting of an oil shale block, 3:21105 (UCRL—52256(Pt.2))
**Coensgen, F.H.,** Mirror machine program in the USA, 3:22540 (UCRL—79870)
*See* Damm, C.C., 3:22543
**Coffman, F.E.,** Overview of near-term magnetic confinement fusion reactor designs, 3:22559
**Coffman, J.A.,** *See* Hooverman, R.H., 3:21303
**Cofone, L. Jr.,** *See* Walker, J.D., 3:22274
**Cohen, I.M.,** Modeling of arc discharges in power circuit breakers. Final report, 3:21529 (EPRI-EL—482)
**Cohen, M.P.,** *See* Corotis, R.B., 3:21461
**Cohn, C.E.,** *See* Herzenberg, C.L., 3:20887
**Cohn, D.R.,** Compact high-field ignition test reactor (HFITR) using bitter magnets, 3:22600
**Cohn, S.H.,** Quantitation of the degree of osteoporosis by measure of total-body calcium employing neutron activation, 3:22244
**Coker, W.B.,** Geochemical exploration for uranium in the Grenville province of Ontario, 3:21130
**Coker, W.R.,** *See* Blanpied, G.S., 3:22354
**Cole, R.J.,** *See* Schuller, C.R., 3:21423
**Cole, R.M.,** *See* Holliden, G.A., 3:21525
**Coleman, J.J.,** Room-temperature visible In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/($x \leqq 1, z \sim 0.6$) heterojunction lasers, 3:22064
**Coleman, L.W.,** *See* Manes, K.R., 3:22647
**Colin, L.,** Exploration of Venus, 3:22302
Pioneer Venus program, 3:22304
**Collins, A.R.,** *See* Bighel, L., 3:22408
**Collins, L.W.,** Thermochemistry of explosives: a review, 3:22135
**Colp, J.L.,** Fine-mesh passive seismic survey of Kilauea Iki lava lake, 3:21452
**Colsher, C.S.,** Evaluation of the radionuclide concentrations in soil and plants from the 1975 terrestrial survey of Bikini and Eneu Islands, 3:22201 (UCRL—51879(Pt.3))
**Colton, E.,** *See* Auer, I.P., 3:22335
**Comon, J.,** *See* Cadiou, L., 3:21564
**Compere, A.L.,** Continuous fixed-film denitrification of high-strength industrial nitrate wastes, 3:21845
**Condit, W.C.,** Second-generation design calculations of the field-reversed mirror reactor, 3:22627
**Condit, W.C. Jr.,** *See* Smith, A.C. Jr., 3:22406
**Coney, M.W.E.,** *See* Yu, S.K.W., 3:21615
**Conn, R.W.,** SOLASE, a laser fusion reactor study, 3:22667
TDHR-a Tokamak demonstraction hybrid reactor, 3:22560
*See* Abdel-Khalik, S.I., 3:22668
**Connell, H.L.,** *See* Moore, R., 3:21340
**Conner, W.D.,** Tertiary oil recovery by $CO_2$ injection, 3:20955 (ORO—5302-16)
Tertiary oil recovery by $CO_2$ injection. Quarterly report, April—June 1977, 3:20956 (ORO—5303-15)
**Connor, J.W.,** Analytical solution for the distribution of neutral particles in a Maxwellian plasma using the method of singular eigenfunctions, 3:22462
**Converse, A.O.,** *See* Downey, W.T., 3:21377
**Conzett, H.E.,** Extreme values of spin-polarization analyzing powers in nuclear reactions: M-matrix conditions, 3:22383
**Cook, D.L.,** *See* Cohn, D.R., 3:22600
**Cook, M.E.,** *See* Salant, R.F., 3:21589
**Cool, R.,** *See* Akimov, Y., 3:22333
**Cooney, J.J.,** *See* Walker, J.D., 3:22274
**Cooney, P.J.,** *See* Gemmell, D.S., 3:22311
**Cooper, G.W.,** Laser design considerations for an inertially confined fusion reactor, 3:22666
*See* Moses, G.A. Conn, R.W., 3:22669
**Cooper, J.,** *See* Schwab, J., 3:20899, 3:20900
**Cooper, J.F.,** *See* O'Connell, L.G., 3:21857
**Cooper, W.S.,** *See* Berkner, K.H., 3:22619
*See* Burrell, C.F., 3:22618
**Cope, S.N.,** Microcomputer-based reactor safety system, 3:21641 (N—77-26941)
**Coppin, C.E.,** *See* Gillins, R.L., 3:21645
**Corbett, J.D.,** *See* Belin, C.H.E., 3:21964
**Corderman, R.R.,** Negative ion chemistry of (eta$^5$-$C_5H_5$)Co(CO)$_2$ in the gas phase by ion cyclotron resonance spectroscopy. The $\pi$-acceptor ability of $PF_3$ compared to CO, 3:21950
**Cordt-Riele, I.,** *See* Blattman, H., 3:22263
**Corfu, R.,** Proposal for an experimental program at SIN. Study of pion—nucleus scattering using a magnetic spectrometer, 3:22367 (LA-tr—84)
**Corley, J.P.,** *See* Moeller, D.W., 3:21202
**Cormack, D.,** Oil pollution control officer training course, 3:21030
**Corman, J.C.,** Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report, 3:21475 (N—77-26631)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report, 3:21476 (N—77-26632)
*See* Bass, R.R., 3:21480
*See* Brown, D.H., 3:21479
**Corotis, R.B.,** Variance analysis of wind characteristics for energy conversion, 3:21461
**Corsini, H.A.,** *See* Hudson, W.T., 3:21345
**Corvini, G.,** Molecular sieve dehydration and treating in expander plants: update, 3:21069 (CONF-7603113—, pp D1-D20)
**Corwin, W.R.,** Evaluation of the fatigue resistance of CDA 182 copper for use in the impurity study experiment fusion research tokamak (ISX), 3:22682 (ORNL—5302)
**Counselman, C.C. III,** *See* Schubert, G., 3:22303
**Countess, R.J.,** Measurements of $^{222}Rn$ flux with charcoal coanisters, 3:22200 (HASL—325, pp 149-154)
**Coutant, C.C.,** *See* Tyndall, R.L., 3:22228
**Couto de Almeida, C.U.,** Brazilian special master's program: an experience, 3:21603
**Craig, J.L.,** *See* Bailey, S.C., 3:21338
**Cramer, N.F.,** *See* Bighel, L., 3:22408
**Crawford, P.B.,** *See* Wiesepape, C.F., 3:21039
**Crittenden, M.,** Environmental aspects of geothermal energy, 3:21434
**Croke, J.F.,** Recent developments in instrumentation for wavelength-dispersive x-ray analysis, 3:21938
**Crolet, J.L.,** *See* Seraphin, L., 3:21568
**Crynes, B.L.,** Catalysts for upgrading coal-derived liquids. Quarterly report, June 9—September 8, 1977, 3:20878 (FE—2011-9)
**Cudlin, J.J.,** *See* Treventi, P.A., 3:21638
**Culberson, S.F.,** LPG/energy-value relationships, 3:21003 (CONF-770375—, pp 147-151)
**Culver, D.,** *See* Bender, D.J., 3:22542
**Culver, D.W.,** Mechanical structure of the mirror hybrid reactor power plant, 3:22575
**Cummings, R.G.,** *See* Burt, O.R., 3:21694
**Cuperman, S.,** *See* Gomberoff, L., 3:22495
**Cupp, G.M.,** Preliminary study of the uranium favorability of granitic and contact-metamorphic rocks of the Owens Valley area, Inyo and Mono Counties, California, and Esmeralda and Mineral Counties, Nevada, 3:21120 (GJBX—3(78))
**Curran, S.,** Energy resources available to man, 3:21695
**Curry, W.E.,** *See* Erikson, E.H., 3:21124
**Cuthrell, R.E.,** Role of ion aggregates in Rebinder-Westwood environmental effects on wear as monitored by acoustic emission, 3:22072

## D

**D'yakov, V.G.,** Corrosion control and selection of materials for refinery equipment, 3:20994
**Dagenhart, W.K.,** *See* Schwenterly, S.W., 3:22684
**Dahlbacka, G.H.,** *See* Pearlman, J.S., 3:22511
**Dailey, N.S.,** Environmental aspects of transmission lines: a selected, annotated bibliography, 3:21531 (ORNL/EIS—122)
**Dalibot, B.,** Examples of applications of RTC terrestrial solar units from 1961 to 1977, 3:21297
**Daly, G.H.,** ERDA's role in low-level waste management, 3:21197
**Damm, C.C.,** Directions for possible upgrades of the Mirror Fusion Test Facility (MFTF), 3:22543 (UCRL—80475)
**Danchev, V.I.,** Distribution of clark uranium in terrigenous strata of Lower Carbonic period in the limits of the Orenburg region, 3:21116
**Dandl, R.A.,** ELMO Bumpy Torus, 3:22536 (CONF-771109—57)
ELMO bumpy torus, 3:22563
**Dang, V.D.,** *See* Steinberg, M., 3:22685
**Daniels, L.S.,** Engineering review and evaluation of Combustion Engineering, Inc., coal gasification process development unit. Final report, 3:20853 (EPRI-AF—558)
**Danilov, V.V.,** *See* Ageev, A.I., 3:22107
**Danilychev, V.A.,** *See* Basov, N.G., 3:22044
**Darley, J.M.,** *See* Seligman, C., 3:21784
**Das, S.K.,** *See* Sinha, M.K., 3:21896
**Dashuk, P.N.,** *See* Andreev, S.I., 3:22413
**Datsykov, S.V.,** *See* Borisov, B.N., 3:22049
**Dattagupta, S.,** *See* Dunlap, B.D., 3:21969
**Daum, M.,** Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions, 3:22332 (LA-tr—77-76)
**Davenport, F.S.,** Water supplies and the nuclear licensing process, 3:21595 (PB—270463)
**Davidson, J.R.,** *See* Asperger, R.G., 3:21068

**Davidson, K.E.,** Backup computer theory for process control computer systems, 3:21619
**Davidson, R.C.,** Influence of finite ion Larmor radius effects on the ion resonance instability in a nonneutral plasma column, 3:22480
**Davis, A.,** *See* Spackman, W., 3:20889
**Davis, C.E.,** Multielement true boiling point gas chromatograph for monitoring oil pollution, 3:21034
**Davis, J.,** *See* Kahlert, G., 3:21842
**Davis, J.W.,** *See* DeFreece, D.A., 3:22573
*See* Kulcinski, G.L., 3:22687
**Davis, R.C.,** *See* Stirling, W.L., 3:22615, 3:22626
**Davis, S.L.,** *See* Brusati, M., 3:22449
**Davison, R.R.,** *See* Harris, W.B., 3:21365
**Davydovskii, V.Y.,** Resonant particles at a wave front in a weakly inhomogeneous plasma, 3:22526
**Dawson, J.M.,** *See* Lin, A.T., 3:22485
**Dayras, R.A.,** *See* Stokstad, R.G., 3:22356
**de Angelis, R.J.,** *See* Fischer, J.R., 3:20871
**de Boor, C.,** Comments on the comparison of global methods for linear two-point boundary value problems, 3:22401
**de la Garza, E.,** *See* Huffman, W.J., 3:21304
**de la Rosa, R.R.,** Steam injection apparatus, 3:21862
**de Mello, R.W.,** Impact of advanced fuel fusion on electric power transmission, 3:22549
**Deberdeev, I.Kh.,** Use of methylisobutylcarbinol for coal flotation, 3:20921
**Debs, A.S.,** Kuwait solar heated and cooled home, 3:21344
Security constrained optimization for power systems, 3:21471
**DeBuchananne, G.D.,** *See* Wood, W.W., 3:21199
**DeCarlo, J.A.,** In-plant coal and ash handling overview, 3:21484 (CONF-770658—, pp 125-148)
**Decker, J.,** Are generalized or unified criteria possible, 3:22547
**Decker, J.F.,** Status report on the current DMFE review of alternative magnetic confinement systems, 3:22562
**DeFreece, D.A.,** Major cost drivers for tokamak fusion power plants, 3:22573
**DeGroot, J.S.,** *See* Woo, W., 3:22509
**Dehmer, J.L.,** Angular distributions of photoelectrons and non-thermal photoions from atoms and molecules, 3:22314 (CONF-770935—4)
**Deich, M.E.,** Analysis of nonstationary processes in saturated steam turbine flow-through sections, 3:21503
**Deitz, V.R.,** Activation of water-soluble amines by halogenes for catching radioactive iodine out of air streams, 3:21176
**Delaunois, C.,** *See* Braekman-Danheux, C., 3:20896
**Dellarciprete, C.,** Territorial and engineering requirements in nuclear stations siting, 3:21622
**Delorme, A.,** *See* Roux, F., 3:21567
**Dement'ev, B.A.,** Investigation of the hydrodynamics of two-phase flow with nonuniform supply of vapor over the cross section, 3:21515
**Demetriades, S.T.,** U-25-C MHD channel analysis open circuit operation. Interim report: Subtask 1 (B). Revision A, 3:21764 (FE—2243-9)
**Demirjian, A.,** Development program for MHD power generation. Quarterly report, April 1976—June 1976, 3:21752 (FE—2015-12)
**Demirjian, A.M.,** *See* Becker, F.E., 3:21753
**DeNike, E.E.,** *See* Clark, R.C. Jr., 3:22270
**Denington, R.J.,** *See* Dustin, M.O., 3:21856
**Denton, T.,** *See* Friedman, I., 3:21136
**Derkach, A.Y.,** Monolithic superconducting solenoids, 3:22009
**Dernbach, N.J.,** Engineers must become more aware of public acceptance, 3:21606
**Derry, D.R.,** New types of deposits will provide future supplies of uranium, 3:21115
**Desrosiers, R.E.,** Chemical equilibrium in ash-laden coal combustion systems, 3:20890 (FE—2205-7)
**Deuchars, W.M.,** *See* Brown, R., 3:22433
**Devillers, C.,** *See* Bouteau, F., 3:22389
**Devoto, R.S.,** *See* Bender, D.J., 3:22542
*See* Damm, C.C., 3:22543
**Dew-Hughes, D.,** Critical-current densities of bronze-processed $Nb_3(Sn_{1-x}Ga_x)$ wires up to 23.5 T, 3:21887
Solid-state (bronze process) $V_3Ga$ from a V-Al alloy core, 3:21885
**Dewar, R.L.,** Random phase wave: a soluble non-Markovian system, 3:22456 (PPPL—1401)
**Deyoung, R.J.,** Nuclear pumped laser. II. Final contractor report, August 1975—August 1977, 3:22021 (N—77-26479)
**Dhir, K.,** *See* Catton, I., 3:21642
**Diamond, R.M.,** *See* Gizon, J., 3:22362
*See* Simon, R.S., 3:22369
**Dick, G.,** Welded pipe line system, insulated by sulfur hexafluoride, made of an aluminium alloy, for power transmission, 3:21533
**Dickey, B.R.,** *See* Slansky, C.M., 3:21169
**Didenko, A.N.,** Beam depolarization in the magnetic field of a synchrotron, 3:22104
**Didenko, V.S.,** Coke yield from the charge, 3:20843
**Diehl, J.R.,** *See* Toeroek, G., 3:21973
**Dierckx, R.,** *See* Heinrich, R.R., 3:22677
**Dietze, H.J.,** *See* Zahn, H., 3:22442
**Dnestrovskii, Yu.N.,** Wave absorption in plasma at the ion-hybrid resonance, 3:22418
**Dobryak, D.S.,** *See* Ionin, D.A., 3:21095
**Dobson, P.S.,** TEM observations of dark defects in degraded gallium arsenide heterojunction lasers, 3:22060
**Dodge, M.C.,** Effect of selected parameters on predictions of a photochemical model, 3:21988 (PB—269858)
**Doering, R.W.,** *See* Duffey, D., 3:21924
*See* Herzenberg, C.L., 3:20887
**Doerk, H.,** Combined heat recovery system in an indoor swimming pool of a school, 3:21794
**Dogotar', A.A.,** *See* Afonin, A.G., 3:22117
**Dohrenwend, R.E.,** Environmental management during power transmission line construction: operational considerations, 3:21552
**Dokiya, M.,** Study of thermochemical hydrogen preparation. II. Electrochemical hybrid cycle using sulfur-iodine system, 3:21249
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**Dombeck, T.W.,** Proposed neutron bottle for the Argonne pulsed neutron source and its application in the search for the neutron electric dipole moment, 3:22119 (ORO—2504-267)
**Dominguez, R.R.,** *See* Berk, H.L., 3:22494
**Donaldson, A.C.,** *See* Renton, J.J., 3:20891
**Donaldson, T.P.,** Studies of pellet evaporation by $CO_2$ laser, using multiple-frame argon-ion laser shadow photography, 3:22434
**Donath, E.E.,** Early coal hydrogenation catalysis, 3:20883
**Donhoffer, D.,** Nuclear techniques in exploration, extraction and processing of mineral resources. Report on the international symposium held in Vienna from 7 to 10 March 1977, 3:20942
**Donnelly, J.P.,** *See* Rossi, J.A., 3:22063
**Donohue, M.D.,** Perturbed-hard-chain theory for correlation of thermodynamic properties, 3:21040 (CONF-770375—, pp 36-41)
**Donovan, J.A.,** Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP—1476)
**Donovan, T.J.,** U.S. Geological Survey project BIRDDOG (basic investigation of remotely detectable deposits of oil and gas), 3:20948
**Doran, D.G.,** HEDL magnetic fusion energy programs. Progress report, April—June 1977, 3:22681 (HEDL-TME—77-81)
**Doran, J.C.,** Accuracy of wind power estimates, 3:21460 (PNL—2442)
**Dorfan, J.,** *See* Perl, M.L., 3:22328
**Dorfan, J.M.,** *See* Meyer, D.I., 3:22327
**Dorokhov, E.V.,** Rational utilization of medium-capacity power blocks when passing through deep lows of electric load graphs, 3:21537
**Dory, R.A.,** *See* Dandl, R.A., 3:22536, 3:22563
**Doschek, G.A.,** *See* Johnson, D.J., 3:22427
**Doss, S.,** Dynamic ADI methods for elliptic equations with gradient dependent coefficients, 3:22691 (LBL—6142)
**Dotter, J.,** Coal supply and transportation overview, 3:20931 (CONF-770658—, pp 189-221)
**Dowdy, E.J.,** Reduced variance multiplication meter for plutonium sample verification and assay applications, 3:21234
**Down, C.G.,** Positive uses of mill tailings, 3:21843
**Downey, W.T.,** Design of flat reflector—collector combinations, 3:21377
**Dreizin, Y.A.,** *See* Bol'shov, L.A., 3:22411
**Drenner, D.C.,** *See* Schwendiman, L.S., 3:22013
**Drickamer, H.G.,** *See* Hara, K., 3:21983
**Driscoll, M.J.,** MIT LMFBR blanket research project. Quarterly progress report, July 1, 1977—September 30, 1977, 3:21580 (COO—2250-30)
**Droullard, R.F.,** Continuous working level monitor, 3:22175 (HASL—325, pp 43-47)
**Drozhdin, A.I.,** *See* Afonin, A.G., 3:22117
**Drummond, C.J.,** *See* Johnson, G.E., 3:20904
**Dryden, E.H.,** *See* Bliss, E.S., 3:22652
**Drysdale, F.R.,** Energetics of the United States of America: an atlas, 3:21677 (BNL—50501-R)
**Dubinski, J.,** *See* Szomodyi, A., 3:22336
**Dubrovskii, A.V.,** *See* Gribkov, V.A., 3:22415
**Duderstadt, J.J.,** *See* Berwald, D.H., 3:22634
**Dudley, D.G.,** Fitting noisy data with a complex exponential series, 3:22694 (UCRL—52242)
**Duewel, G.,** Technical and economic development trends in the gas supply industry, 3:21090
Tendencies of technical and economic development in the public gas supply industry, 3:21089
**Duffey, D.,** Beryllium-reflected coal analytical assembly using $^{252}Cf$ neutron-capture gamma rays, 3:21924
*See* Herzenberg, C.L., 3:20887
**Duffy, M.A.,** *See* Ollila, R.G., 3:21801
**Dufresne, J.,** New development of the Tealarc natural gas liquefaction process, 3:21085
**Dumont, R.S.,** *See* Besant, R.W., 3:21352
**Dunand-Roux, L.,** *See* Cadiou, L., 3:21564
**Dunbar, P.M.,** Theoretical effects of surface diffused region lifetime models on silicon solar cells, 3:21285

**Duncan, D.A.,** Riser cracking of coal to oil and gas, 3:20875 (CONF-770814—10)
**Duncan, D.L.,** Radon and radon daughters: measurement and analysis successes and difficulties experienced by EPA, 3:22180 (HASL—325, pp 78-89)
**Dunlap, B.D.,** Paramagnetic spin relaxation in $Cs_2NaYbCl_6$, 3:21969
**Dunwoodie, W.M.,** *See* Carnegie, R.K., 3:22351
**Duport, P.,** Experimental study of the penetration of radioactive aerosols into the respiratory tract, 3:22267 (ORNL-tr—4526)
**Dupuis, C.,** *See* Charlet, J.M., 3:21133
**Durocher, D.F.,** *See* Fennelly, P.F., 3:20929
**Dustin, M.O.,** Test and evaluation of 23 electric vehicles for state-of-the-art assessment, 3:21856 (CONS/1011—21)
**Dutov, A.I.,** *See* Avanesyan, V.S., 3:22055
**Dutray, G.,** Boiler conservation during stoppages, 3:21512
**Dvoskin, D.D.,** *See* Heady, E.O., 3:21718
**Dyachenko, A.G.,** *See* Pozin, L.Z., 3:21083
**Dyad'kin, A.P.,** *See* Vasil'ev, B.I., 3:22048
**Dyatlov, V.D.,** Activation detectors for recording pulsed fluxes of fast neutrons, 3:22121 (ORNL-tr—4529)
**Dyer, C.S.,** Calculation of radioactivity induced in scintillator materials during spaceflight, 3:22293
**Dyer, N.C.,** Procedures: Source Term Measurement Program, 3:21623 (NUREG—0384)
**Dykhne, A.M.,** *See* Bol'shov, L.A., 3:22411
**Dymshits, B.M.,** *See* Andronov, G.A., 3:22047
*See* Sharkov, V.F., 3:22054
**Dyuzhakin, M.G.,** *See* Blagodarnaya, L.F., 3:21015
**Dzubay, T.G.,** Recent advances in energy-dispersive XRF analysis of aerosol samples, 3:21937

## E

**Easter, R.B.,** *See* Campen, G.L., 3:22603
**Easterbrook, G.D.,** *See* Basham, I.R., 3:21132
**Eastman, L.F.,** Gallium arsenide and related compounds (St. Louis), 1976, 3:22061
**Eaton, W.C.,** *See* Ripperton, L.A., 3:22147
**Ebeling, K.,** *See* Krug, H., 3:22235, 3:22236, 3:22237
**Eccleston, G.W.,** Delayed neutron spectra from $^{232}Th$, $^{233}U$, $^{235}U$, and $^{239}Pu$, 3:22379 (RLO/2225/T3—6)
**Eckart, L.E.,** Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants, 3:22196
**Eckels, J.D.,** *See* Slivinsky, V.W., 3:22648
**Edelstein, N.M.,** *See* Reynolds, J.G., 3:21996
**Eden, A.,** Improving the performance of a solar energy heating system, 3:21356
**Edgecombe, A.L.,** *See* Clausing, A.M., 3:21382
**Edgington, D.N.,** Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**Edling, D.A.,** *See* Watkins, R.A., 3:22012
**Efimov, A.I.,** *See* Marchenko, Yu.A., 3:21497
**Ehlenberger, R.,** *See* Schwab, J., 3:20899, 3:20900
**Ehlers, K.W.,** *See* Berkner, K.H., 3:22619
**Ehrlich, M.,** Exposure spectra from NBS vertical-beam $^{60}Co$ gamma-ray source. Final report, 3:21238 (PB—269341)
**Ehst, D.,** *See* Brooks, J.N., 3:22676
**Eichler, H.J.,** *See* Schaefer, G., 3:22038
**Eichler, J.,** *See* Schaefer, G., 3:22038
**Eidman, V.R.,** Agricultural energy modeling: discussion of linear programming models, 3:21719
**Ellerts, C.K.,** Bush Dome model computing movement of injected crude helium. General instruction manual for computer program KWDX-577-mp for computing gas movement in a gas storage reservoir. Final report, 3:21691 (PB—269451)
**Eisenberg, D.M.,** *See* Benemann, J.R., 3:21311
**Eising, J.P.,** Combustion heating apparatus to improve operation of gas pilot burners, 3:22085
**Eisner, E.,** One-dimensional inversion of seismograms, 3:20947
**El-Badry, Y.Z.,** *See* Sulzberger, V.T., 3:21521
**El-Hak, L.G.,** *See* El-Khalafawy, T.A., 3:22514
**El-Hawary, M.E.,** *See* Nieva, R., 3:21617
**El-Khalafawy, T.A.,** Possible mechanism of microwave emission from a theta-pinch discharge in presence of a superimposed azimuthal magnetic field, 3:22514
**Eldridge, O.C.,** *See* Spong, D.A., 3:22491
**Elekhov, M.S.,** Quality characteristics and floatability of Pechora coals, 3:20920
**Elias, E.,** *See* Reynolds, G.M., 3:21922
**Eliseev, P.G.,** *See* Ismailov, I., 3:22053
**Elkin, V.M.,** Experience in operating biological treating facilities of Angarsk Petrochemical Combine, 3:21010
**Ellett, W.H.,** Exposure to radon daughters and the incidence of lung cancer, 3:22256
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL—325, pp 102-104)
**Elliot, D.G.,** *See* Chappelear, P.S., 3:21064
**Ellis, K.J.,** *See* Cohn, S.H., 3:22244
**Ellis, S.D.,** *See* Carlitz, R.D., 3:22329
**Elson, J.M.,** *See* Scott, M.L., 3:22030
**Ely, R.,** *See* Meyer, D.I., 3:22327
**Emel'yanov, I.Ya.,** On the complex analysis of the reliability, safety, and economic efficiency of atomic electric power stations, 3:21597
**Eng, K.Y.,** *See* Kruger, G.B., 3:21578
**Engelmann, R.J.,** *See* Kephart, R.D., 3:22334
**Enger, M.D.,** Stimulation of informosomal RNA synthesis in cultured Chinese hamster cells exposed to low levels of cadmium, 3:22272
**Engi, D.,** Valued renewal processes, 3:22002 (SAND—77-1436C)
*See* Boozer, D.D., 3:21221
**Ensslin, N.,** Thermal-neutron coincidence counting of large plutonium samples, 3:21230
**Entov, V.M.,** Effect of pressure variation in a stratum on hydrodynamic characteristics of neighboring strata, 3:22285
**Eppel', S.A.,** *See* Amosov, V.V., 3:21013
*See* Kochetkova, R.P., 3:21018
**Epstein, M.M.,** *See* Ollila, R.G., 3:21801
**Eraslan, A.H.,** Simulation of chlorinated water discharges from power plants on estuaries and rivers, 3:22216
Thermal impact assessment of multi-power plant operations on estuaries, 3:22229
**Eremenko, E.V.,** *See* Baratov, D.G., 3:22116
**Erickson, G.J.,** *See* Huempfner, R.A., 3:22209
**Erikson, E.H.,** Preliminary study of the uranium favorability of tertiary rocks, southeastern Oregon: eastern Klamath, Southern Lake, Harney, and western Malheur Counties, 3:21124 (GJBX—92(77))
**Erkkila, B.H.,** *See* Britt, H.C., 3:22364
**Ernest, A.K.,** Mechanism of corrosion of waterwalls when burning oil of high sulfur content, 3:21468
**Es'kov, A.G.,** Control of the formation of a compact toroidal structure with a pulsed barrier field, 3:22601 (UCRL-Trans—11290)
**Esina, Z.N.,** *See* Didenko, A.N., 3:22104
**Esparza, V.,** Experiment data report for semiscale Mod-1 test S-28-4 (steam generator tube rupture test), 3:21647 (TREE-NUREG—1151)
**Espenson, J.H.,** *See* Bushey, W.R., 3:21957
**Essenhigh, R.H.,** *See* Spackman, W., 3:20889
**Estes, B.F.,** *See* Schmidt, T.R., 3:21625
**Estes, Z.,** Summary of chlorine free synthesis of TATB. Process Development Endeavor No. 106, 3:22133 (MHSMP—77-57)
**Eustis, R.H.,** High magnetic field MHD generator program. Quarterly report, January—March 1977, 3:21765 (FE—2341-2)
**Evans, K. Jr.,** *See* Stacey, W.M. Jr., 3:22535
**Evans, M.L.,** *See* Ensslin, N., 3:21230
**Evans, R.B. III,** *See* Shaffer, J.H., 3:21152
**Evdokimov, B.V.,** Thermostable flushing fluids for well drilling in West Siberia, 3:20965
**Eyre, D.,** *See* Besant, R.W., 3:21352

## F

**Fabbi, B.P.,** Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**Fabre, E.,** Structures of photocells: homojunctions, heterostructures or heterojunctions, 3:21293
**Fabry, A.,** Review of microscopic integral cross section data in fundamental reactor dosimetry benchmark neutron fields, 3:22378 (HEDL-SA—1148(Rev.1))
**Faibis, A.,** *See* Gemmell, D.S., 3:22311
**Falco, C.M.,** *See* Wu, C.T., 3:22008
**Faleeva, O.I.,** *See* Elkin, V.M., 3:21010
**Faltens, A.,** Acceleration systems for heavy-ion beams for inertial confinement fusion, 3:22639 (LBL—6768)
**Farber, P.S.,** Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101—3)
**Farmakes, R.,** Transactions of the American Nuclear Society 1977 winter meeting held Nov. 27—Dec 2, 1977, in San Francisco, California, 3:21554
**Farmer, P.R.,** *See* Yu, S.K.W., 3:21615
**Farrar, G.R.,** Neutrino and antineutrino proton scattering data and the ratio of down to up quarks in the proton, 3:22330
**Farrar, H. IV,** *See* Heinrich, R.R., 3:22677
**Farrington, J.W.,** Evaluation of some methods of analysis for petroleum hydrocarbons in marine organisms, 3:21053
**Fasolo, J.A.,** Power and gas flow models for monoenergetic neutral beam injectors, 3:22616 (CONF-771029—188)
**Fassbender, L.L.,** *See* Conn, R.W., 3:22560
**Faust, P.,** Situation on the LNG tanker market, 3:21092

**Feely, H.W.,** Radionuclides and lead in surface air, 3:22159 (EML—334(App.), pp B.1-B.155)
*See* Toonkel, L.E., 3:22154
**Fehlner, F.P.,** *See* Ortabasi, U., 3:21367
**Feldman, C.,** Spectroscopic element detector for gas chromatography, 3:21929
**Feldman, G.J.,** *See* Meyer, D.I., 3:22327
*See* Perl, M.L., 3:22328
**Feldman, M.J.,** U.S. nonproliferation policy and the reactions of the technical community, 3:22139 (CONF-771055—1)
**Feldman, U.,** *See* Johnson, D.J., 3:22427
**Feldman, W.C.,** *See* Gary, S.P., 3:22481
**Feller, J.,** *See* Meyer, D.I., 3:22327
**Fenical, W.,** Sphaerococcenol A: a new rearranged bromo-diterpene from the red alga Sphaerococcus coronopifolius, 3:22240
**Fennelly, P.F.,** Preliminary environmental assessment of coal-fired fluidized-bed combustion systems. Preliminary report September 1975—June 1976, 3:20929 (PB—269556)
**Ferguson, R.B.,** Field manual for stream water and sediment reconnaissance, 3:21119 (DPST—77-363)
*See* Heffner, J.D., 3:21118
**Ferguson, R.L.,** *See* Britt, H.C., 3:22364
**Fernandez, B.,** *See* Britt, H.C., 3:22364
**Ferrer, J.,** *See* Menasian, S.C., 3:22437
**Ferriol, J.,** *See* Rabbe, P., 3:21565
**Fick, T.R.,** Technical issues in geothermal power development, 3:21436
**Filby, R.H.,** Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**Filges, D.,** *See* Kuijpers, L., 3:22581
**Filinov, M.V.,** *See* Kochina, I.N., 3:21099
**Filippov, G.A.,** *See* Deich, M.E., 3:21503
**Filippov, N.V.,** Method of studying the spectral composition of powerful high-energy deuteron beams formed in a plasma focus, 3:22451 (UCRL-Trans—11307)
**Filippov, V.I.,** *See* Borisov, B.N., 3:22049
**Filippova, T.I.,** *See* Filippov, N.V., 3:22451
**Fillo, J.,** *See* Yu, W.S., 3:22612
**Finer, J.,** *See* Fenical, W., 3:22240
**Fink, J.,** Engineering problems of future neutral beam injectors, 3:22620 (UCRL—80384)
**Fink, J.H.,** *See* Bender, D.J., 3:22542
**Fink, R.W.,** Proton-induced x-ray emission multielement analysis in biomedical, environmental, geological, and archaeological specimens, 3:21940
**Finley, J.S.,** *See* Clark, R.C. Jr., 3:22270
**Fiore, N.F.,** Microstructural effects in abrasive wear. Quarter progress report, June 16—September 15, 1977, 3:21878 (COO—4246-2)
**Firment, L.E.,** Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL—6017)
**Fischer, J.R.,** Metallographic and chemical analyses of a plain carbon steel plate after long term service in a coal gasifier, 3:20871
**Fischer, S.K.,** *See* Eraslan, A.H., 3:22216
**Fishman, G.J.,** Radiation in space and its effects on high-energy astronomy experiments: a summary, 3:22298
**Fishman, L.L.,** *See* Surkov, Yu.V., 3:21082
*See* Turevskii, E.N., 3:20995
**Fisk, R.J.,** *See* Kephart, R.D., 3:22334
**Fite, W.L.,** Uranium atoms and ions in the gas phase. Progress report, March 1, 1977—February 28, 1978, 3:21141 (COO/4295—1)
**Fitz, H.,** *See* Justi, E., 3:21368
**Fix, J.J.,** Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971—1975, 3:22207 (PNL—2383)
**Flad, J.,** Combined gas/steam-turbine power station belonging to the Stadtwerke Saarbruecken AG, 3:21519
**Flageul, J.M.,** *See* Murat, M., 3:21853
**Flanagan, T.B.,** *See* Tanaka, S., 3:21254
**Flanagan, T.M.,** *See* Watkins, R.A., 3:22012
**Flanigan, V.J.,** *See* Anderson, L.A., 3:21406
**Fleischmann, H.H.,** *See* Smith, A.C. Jr., 3:22406
**Fleming, J.R.,** *See* Holden, S.C., 3:21274
**Flynn, G.W.,** *See* Preses, J.M., 3:21989
*See* West, G.A., 3:22322
**Flynn, M.J.,** Studies in the organization of computer systems. 1977 progress summary. Technical note No. 121, 3:22693 (SU—326-P.39-26)
**Folkeson, L.,** Lead, expecially exhaust lead, in the terrestrial environment: accumulation and ecological effects. A literature survey, 3:22148 (SNV-PM—794)
**Folkmann, F.,** *See* Britt, H.C., 3:22364
**Fomin, N.A.,** *See* Spiridonov, Yu.G., 3:21902
**Fomin, V.A.,** *See* Mazagarov, A.M., 3:21086
**Fong, J.C.,** *See* Blanpied, G.S., 3:22354
**Fontana, A.,** *See* Benedetti, D., 3:21265
**Forster, G.A.,** *See* Raptis, A.C., 3:21579
**Fortmann, H.R.,** Energy policy and research: discussion from a land-grant-institution perspective, 3:21700
**Fortune, C.R.,** *See* Cheney, J.L., 3:20905
**Fortune, P.J.,** Design and implementation of a local computer network, 3:22689 (CONF-7706104—1)
**Fouad, A.A.,** Transient stability criteria, 3:21538
**Fountain, W.D.,** *See* Johnson, B.C., 3:22036
**Fowler, L.L.,** Method of converting oil and waste containing sludge to dry waste, 3:21005
**Fowler, T.K.,** *See* Baldwin, D.E., 3:22596
**Fox, G.R.,** *See* Corman, J.C., 3:21475
**Fox, K.,** Computation of cubic harmonics, 3:22399
**Fox, T.D.,** *See* Doran, J.C., 3:21460
**Franck, J.V.,** SCR series switch and impulse crowbar at the Lawrence Berkeley Laboratory for CTR neutral beam source development, 3:22602 (LBL—6382)
**Frank, A.L.,** Radon and daughter measurements with active and passive devices using track etch detectors, 3:22165 (HASL—325, pp 6-8)
**Frank, H.,** Multistage cooling of crude hydrocarbon gases, 3:20987
**Frank, T.G.,** *See* Booth, L.A., 3:22663
**Frank, U.,** Identification of petroleum oils by fluorescence spectroscopy, 3:22222
**Frankel, H.E.,** *See* Bangs, E.R., 3:20872
**Franklin, H.,** *See* Knutson, E.O., 3:22190
**Franklin, J.C.,** *See* Bates, R.C., 3:21216
**Franklin, J.L.,** *See* Saaski, E.W., 3:21530
**Franz, G.A. III,** Instrumentation use in the uranium mill tailings program in Colorado, 3:22182 (HASL—325, pp 105-107)
**Freeman, J.E.,** Information and data flows in societal problem areas: focus—energy. Final report, 3:21683 (PB—269497)
**Freeman, J.R.,** Numerical methods for studying compressed magnetic field generators, 3:22599
**Frenzel, M.,** What use are econometers. Greater discipline in driving by fuel consumption indicating devices, 3:21864
**Frichevski, D.,** *See* Borka, S., 3:21889
**Fricsovszky, D.,** *See* Borka, S., 3:21875
**Friedland, B.,** Control system design using radioactive pickoff, 3:22127
**Friedman, I.,** Mobile helium sniffer for petroleum, uranium and geothermal prospecting, 3:21136
**Fritz, J.S.,** *See* Chriswell, C.D., 3:21945
**Fritz-Niggli, H.,** *See* Baarli, J., 3:22262
*See* Blattman, H., 3:22263
**Frolov, A.M.,** *See* Baratov, D.G., 3:22109
**Fromont, M.,** *See* Marbach, G., 3:21892
**Frosch, R.,** *See* Daum, M., 3:22332
**Frost, J.K.,** *See* Ruch, R.R., 3:21919
**Frueholz, R.P.,** Doublet→quartet transitions in nitric oxide as detected by electron-impact spectroscopy, 3:22320
**Fu, Y.C.,** Coal liquefaction and desulfurization, utilizing synthesis gas, 3:20884
**Fujino, M.,** Measurements of energy dependent Doppler factor for uranium dioxide using a lead slowing-down time spectrometer, 3:21146
**Fujita, T.,** Self-oscillations excited by two stream ion-ion instability, 3:22490
**Fukuda, K.,** *See* Dokiya, M., 3:21249, 3:21250
**Fuller, D.,** *See* Wilke, D.A., 3:21361
**Fuller, G.M.,** Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER—582)
**Funahashi, A.,** *See* Takeuchi, H., 3:22412
**Funakawa, H.,** *See* Michiyoshi, I., 3:22609
**Fung, P.C.W.,** *See* Cheng, F.T., 3:22524, 3:22525
**Funk, V.T.,** *See* Carrales, M. Jr, 3:20958
**Furuta, T.,** *See* Donhoffer, D., 3:20942
**Fushimi, F.C.,** *See* Seabaugh, P.W., 3:21232

## G

**Gabano, J.P.,** *See* Jumel, Y., 3:21675
**Gabr, A.A.,** *See* El-Khalafawy, T.A., 3:22514
**Gabriel, T.A.,** Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM—6108)
**Gabrielse, G.,** *See* Berry, H.G., 3:22130
**Gadzhiev, M.A.,** Evaluation of the information content of oil well products using the data about their structural and mechanical properties, 3:21046
**Gafurov, A.M.,** *See* Aksenov, L.F., 3:21335
**Gagen, Yu.G.,** Investigations of displacements of open sections of pipelines, 3:21096
**Gaidash, N.L.,** *See* Gagen, Yu.G., 3:21096
**Gakner, A.,** *See* Salkov, H.R., 3:21727
**Galimov, E.M.,** The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules, 3:21985 (N—77-26240)
**Gallagher, J.G.,** Engineer-constructor's approach to reliability engineering in nuclear power plants, 3:21662
**Gallaher, J.B.,** Development of an automated foam processing system. Final report, 3:21910 (BDX—613-1691(Rev.))
**Gallaher, R.B.,** *See* Scott, R.L., 3:21653, 3:21654
**Galligan, J.M.,** *See* Pang, C.S., 3:21886
**Galloway, T.R.,** *See* Bender, D.J., 3:22542
**Galstar, S.,** *See* Appel, H., 3:22111
**Galutkina, K.A.,** *See* Bibikov, G.G., 3:21017
**Gandy, R.,** *See* Marchini, R., 3:21371
**Gannon, R.,** *See* Ubhayakar, S.K., 3:20855
**Gannon, R.E.,** *See* Demirjian, A., 3:21752
**Garaud, J.,** Availability and safety of nuclear power stations, 3:21655

**Garbee, A.K.,** Blast furnace coal injection at Armco's Ashland Works, 3:21809 (CONF-770658—, pp 53-65)
**Garifo, L.,** *See* Bertotti, B., 3:22656
**Garner, C.K.,** *See* Volborth, A., 3:20888
**Garner, F.A.,** Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA—1252)
**Garrett, D.E.,** Conversion of biomass materials into gaseous products. Bimonthly technical status report, December 15, 1976—February 15, 1977, 3:21306 (CONF-770235—, pp 20p, Paper 4)
**Garrett, J.D.,** *See* Britt, H.C., 3:22364
**Garrett, P.M.,** Overview of low-level radwaste management, 3:21200
**Garside, L.J.,** Wells drilled for oil and gas in Nevada through 1976, 3:20982
**Garten, C.T. Jr.,** *See* Hoffman, F.O., 3:22208
**Garth, B.H.,** Mannich Bases containing tertiary amines and fuel compositions containing said Mannich Bases, 3:21982
**Gary, S.P.,** Second-order theory for kparallelB$_0$ electromagnetic instabilities, 3:22481
**Gasteiger, R.,** Development of an irradiation technology for the recycling of Am-241 in nuclear reactors. A contribution to the possibilities for the reduction of the hazard potential of $\alpha$-bearing wastes, 3:21171 (KFK—2431)
**Gates, W.C. Jr.,** *See* Suggitt, R.M., 3:20986
**Gatseos, P.M.,** *See* Freeman, J.E., 3:21683
**Gauberthier, J.,** *See* Dufresne, J., 3:21085
**Gavett, E.E.,** Energy policy and research in agriculture, 3:21724
**Gear, C.W.,** *See* Petzold, L., 3:22690
**Gearhart, C.A. Jr.,** Measurements of the osmotic pressure in liquid mixtures of $^3$He and $^4$He near the lambda line and tricritical point, 3:22324 (TID—27646)
**Gehrke, R.J.,** *See* Greenwood, R.C., 3:22360
*See* Helmer, R.G., 3:22359
*See* Reich, C.W., 3:22361
**Gelbard, E.M.,** Neoclassical transport of a multi-species plasma in a mixed regime with several collisional species, 3:22460
**Gelbke, C.K.,** Influence of intrinsic nucleon motion on energy spectra and angular distributions for $^{16}$O-induced reactions at 20 MeV/A, 3:22374
**Geller, V.M.,** *See* Muller, Y.N., 3:22045
**Gemmell, D.S.,** Effects seen in the interactions of fast molecular-ion beams with matter, 3:22311 (CONF-770931—4)
**George, A.C.,** Passive environmental radon monitor, 3:22170 (HASL—325, pp 25-30)
**Gerasimov, S.N.,** *See* Bortnikov, A.V., 3:22555
**Gerasimova, E.M.,** Radiation resistance of silicon photoconverters with built-in electrical field in the base, 3:21290
**Gerber, V.Ya.,** Kinetics of biochemical oxidation of refinery wastewaters, 3:21008
Use of technical oxygen for biochemical treatment of refinery wastewaters, 3:21009
**Gerchikov, A.Ya.,** *See* Gerber, V.Ya., 3:21008
**Gerdin, G.,** *See* Miley, G.H., 3:22624
**Gerdin, G.A.,** Advanced fuel bumpy tori, 3:22564
**Gerlach, R.,** Sensitive optoacoustic detection of carbon monoxide by resonance absorption, 3:22150
**Gerry, E.T.,** *See* Rather, J.D.G., 3:22020
**Gerstner, H.B.,** *See* Waters, E.M., 3:21984
**Gervais, R.L.,** *See* Hallet, R.W. Jr., 3:21318, 3:21319, 3:21320, 3:21321
**Gesell, T.F.,** Measurements of $^{222}$Rn in water and indoor airborne $^{222}$Rn originating in water, 3:22221 (HASL—325, pp 132-140)
**Geutjes, A.J.,** Numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature, 3:21760 (N—77-26439)
**Giacchetti, G.,** *See* Benedict, U., 3:21150
**Giammar, R.D.,** Institutional boiler conversion, 3:22084 (CONF-770658—, pp 99-124)
**Gibson, F.P.,** *See* Steverding, B., 3:22443
**Gibson, R.D.,** Flow of heat between bodies in gas-filled contact, 3:22069
**Gil'man, K.M.,** *See* Pokhmurskii, V.I., 3:20983
**Gillam, J.D.,** *See* Archer, V.E., 3:21209
**Gilliam, D.M.,** *See* Fabry, A., 3:22378
**Gillins, R.L.,** Experiment data report for semiscale Mod-1 test S-06-4 (LOFT counterpart test), 3:21645 (TREE-NUREG—1124)
**Gillis, P.P.,** *See* Fischer, J.R., 3:20871
**Gilmore, W.R.,** Radioactive waste disposal: low and high level, 3:21174
**Ginsburg, T.,** Effect of detonation depth on the action of underground explosions in rock, 3:22137 (LA-tr—77-65)
**Girardin, E.K.,** *See* Judd, B.T., 3:21868
**Given, P.H.,** *See* Spackman, W., 3:20889
**Gizon, A.,** *See* Gizon, J., 3:22362
**Gizon, J.,** Hsub(1/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce, 3:22362
**Gladilin, V.I.,** *See* Lokshin, V.A., 3:21508
**Glancy, J.E.,** *See* Kull, L.A., 3:21226
**Glaros, S.S.,** Energy balance measurements for Shiva, 3:22649 (UCRL—79801)
*See* Kornblum, H.N., 3:22425
**Glascock, M.D.,** Lifetime of the 376.7-keV level and shape coexistence in $^{111}$Ag, 3:22363
**Glashausser, C.,** *See* Blanpied, G.S., 3:22354
**Glasov, B.V.,** *See* Derkach, A.Y., 3:22009
**Glass, I.I.,** Effects of hydrogen impurities on shock structure and stability in ionizing monatomic gases. II. Krypton, 3:22523
**Glassey, C.R.,** Extensions of Kalman recursive estimation theory to retrospective updating and interpolation with applications to instrument calibration, 3:21222 (UCRL—13733-5)
**Glaze, J.A.,** *See* Manes, K.R., 3:22647
**Gluck, D.,** *See* Buck, J.V., 3:21415
**Glukhikh, V.A.,** Research and design-construction work of the Scientific Research Institute of Electrophysical Apparatus in the field of controlled thermonuclear fusion, 3:22576 (ORNL-tr—4531)
**Glusker, B.N.,** *See* Shmukler, B.I., 3:21493
**Gnilke, V.,** *See* Kerimov, Z.G., 3:20970
**Godik, I.B.,** Design analysis of thermal and hydrodynamic characteristics of a vertical once-through steam generator with the unit capacity of 500 MW (el.), 3:21488
**Goeldner, U.,** *See* Pirk, H., 3:21148
**Gofaizen, A.V.,** Determining the efficiency of p.f. preparation under conditions of varying load of a generating unit, 3:20919
**Gogolak, C.V.,** Variation of radon and radon daughter concentrations with height above ground, 3:22177 (HASL—325, pp 65-68)
**Gol'tsova, Yu.K.,** Parametric amplification during interaction of stable and unstable waves, 3:22505
**Gold, R.,** *See* Heinrich, R.R., 3:22677
**Goldberg, M.D.,** *See* Carroll, T.O., 3:21679
**Golden, J.E.,** Tailoring electron velocity distributions in phase space (morphodynamics), 3:22446
**Goldhaber, G.,** *See* Perl, M.L., 3:22328
**Goldman, M.,** Estimate of early mortality and morbidity following acute inhalation of plutonium, 3:22255
**Goldman, T.,** Single-cluster descriptions of jets in $e^+e^-$ annihilation, 3:22344
**Goldring, G.,** *See* Gemmell, D.S., 3:22311
**Goldschmidt, B.,** Contribution to the general discussion by delegate from France, 3:21704 (CONF-770971—1)
**Goldstein, D.J.,** Water conservation and pollution control in coal conversion processes. Final report June 1975—December 1976, 3:20913 (PB—269568)
**Goldstein, J.C.,** *See* Goldstein, L., 3:22391
**Goldstein, L.,** Formal approach to various properties of antiferromagnets, 3:22391
**Goldstone, P.D.,** *See* Britt, H.C., 3:22364
**Golubev, V.S.,** *See* Belykh, A.D., 3:21757
**Gomberoff, L.,** Modifications in the maximum convective growth rate of the electromagnetic proton cyclotron instability due to the presence of thermal ions, 3:22495
Quantum field theoretical approach to plasmas, 3:22465
**Gombolevskii, V.I.,** *See* Gofaizen, A.V., 3:20919
**Gomez del Campo, J.,** *See* Stokstad, R.G., 3:22356
**Goncharov, I.N.,** *See* Borka, S., 3:21875, 3:21889
**Gondhalekar, A.,** Scheme for $CO_2$ laser scattering to measure the ion temperature in a tokamak plasma, 3:22441
**Gonta, Z.T.,** Characteristics of geothermal conditions of the northern near-Boart zone of the Dnieper-Donets depression, 3:21453
**Gonzales, S.,** Supplemental field and literature investigation of the upper cretaceous Austin Group (chalk) of Texas with regard to its potential for radioactive-waste isolation, 3:21191 (Y/OWI/SUB—4310/4)
**Good, M.L.,** *See* Kephart, R.D., 3:22334
**Good, W.M.,** *See* Musgrove, A.R.L., 3:22365
**Goodland, R.,** Ecological perspectives of power transmission, 3:21543
Power lines and the environment, 3:21542
**Goodlett, C.B.,** *See* Bradley, R.F., 3:21165
**Goodson, D.,** *See* Schwab, J., 3:20899, 3:20900
**Goodwin, A.R.,** *See* Pion, M., 3:22059
**Gorbanenko, A.D.,** Problem of determination of nitrogen oxides, 3:21007
**Gorbunov, L.M.,** *See* Anosova, L.M., 3:22468
**Gordon, B.G.,** Investigation of variation of the parameters of a medium in a pressurized space after loss of tightness in a high-pressure loop, 3:21660
**Gordon, T.,** *See* Robertson, T.L., 3:22247
**Gorechenkov, V.G.,** *See* Turevskii, E.N., 3:20995
**Gorev, V.V.,** Nonlinear dissipation effects on spectra of the strong Langmuir turbulence, 3:22532
**Gorin, E.,** Production of a hydrogen-rich gas from a CO-containing fuel gas, 3:21244
**Goris, M.L.,** Alternative displays in nuclear medicine, 3:22243
**Gorskii, E.R.,** *See* Manicyev, O.D., 3:21489
**Gottschalk, W.L.,** Cortade Library: system performance of first vertical wall passive solar collector array in Orange, Virginia (private library retrofit), 3:21342
System performance of first commercial solar installation in Orange, Virginia (retrofitted office building), 3:21343

**Goulianos, K.,** *See* Akimov, Y., 3:22333
**Govek, M.,** *See* Ralston, D., 3:20881
**Govorushchenko, Yu.N.,** *See* Boiko, A.V., 3:21491
**Gozani, T.,** *See* Reynolds, G.M., 3:21922
**Grachev, V.A.,** *See* Lyudomirskii, B.N., 3:21498
**Grady, L.M.,** Automated approach to nuclear facility safeguards effectiveness evaluation, 3:21231
**Graf, C.,** *See* Ralston, D., 3:20881
**Graham, C.D.,** Research and development of low-cost processes for integrated solar arrays. Semi-annual report No. 3, 1 January—30 June 1975, 3:21281 (PB—269670)
**Graham, E.E.,** *See* Judd, B.T., 3:21868
**Granatstein, V.L.,** *See* Hirshfield, J.L., 3:22409
**Grannan, D.M.,** Polarization of prompt muons produced at large transverse momenta, 3:22331
**Grasyuk, A.Z.,** *See* Vasil'ev, B.I., 3:22048
**Graveson, R.T.,** Survey of radon monitoring techniques, 3:22168 (HASL—325, pp 20-21)
**Gray, L.W.,** Explosion and fire during conversion of liquid uranyl nitrate to solid uranium oxide, 3:21212
**Gray, W.H.,** *See* Schwall, R.E., 3:22591
**Gray, W.O.,** 1973 IMCO convention: a tanker operator's viewpoint, 3:21022
**Grechko, Yu.I.,** *See* Miroshnichenko, A.M., 3:20844
**Grechukh, Z.G.,** *See* Brudnyi, V.N., 3:21897
**Greco, A.,** *See* Bertotti, B., 3:22656
**Green, M.A.,** *See* Kong, A.K., 3:21283
**Green, S.J.,** *See* Black, A.D., 3:20952
**Greene, F.T.,** *See* Milne, T.A., 3:20928
**Greeneich, E.W.,** *See* Shirland, F.A., 3:21282
**Greenspan, E.,** Catalyzed deuterium fusion-fission hybrid reactors, 3:22570
Feasibility of beam driven semi-catalyzed deuterium fusion neutron sources for hybrid reactor applications, 3:22683 (PPPL—1399)
**Greenwood, A.R.,** Hydrogen-producing hydrocarbon conversion with gravity-flowing catalyst particles, 3:20984
**Greenwood, L.R.,** *See* Heinrich, R.R., 3:22677
**Greenwood, R.C.,** Decay of $^{134}$La, 3:22360 (TREE—1115, pp 14-20)
*See* Helmer, R.G., 3:22359
*See* Reich, C.W., 3:22361
**Greil', A.D.,** Results of thermal tests of the prototype of the type t-250/322-240 turbine set made by the urals turbomachinery plant, 3:21501
**Greywall, M.S.,** Outer shock structure of shock-waves propagating in partially ionized gases, 3:22528
**Gribkov, V.A.,** Effectiveness of interaction of an electron flux with high $\nu/\gamma$ with preliminary heating of a plane target, 3:22415 (ORNL-tr—4537)
**Grif, G.I.,** *See* Muller, Y.N., 3:22045
**Griffin, J.F.,** *See* Watkins, R.A., 3:22012
**Griffith, W.L.,** *See* Compere, A.L., 3:21845
**Griffiths, R.T.,** Effect of aerofoil characteristics on windmill performance, 3:21462
**Grigor'ev, B.A.,** *See* Kurumov, D.S., 3:21042
**Grigor'ev, E.I.,** Some problems involved in the development of a solar thermionic power plant, 3:21301
**Grigor'eva, G.M.,** *See* Gerasimova, E.M., 3:21290
**Grigor'eva, L.,** *See* Szomodyi, A., 3:22336
**Grigor'yan, G.M.,** *See* Sharkov, V.F., 3:22054
**Grigorov, N.,** *See* Szomodyi, A., 3:22336
**Grigsby, L.L.,** *See* Rahman, S., 3:21598
**Grimmer, D.P.,** Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results, 3:21378
**Grinberg, I.V.,** Pyrolysis of Carpathian menilitic shales and production of cellular materials from them, 3:21106
**Griscom, R.W.,** *See* Littman, F.E., 3:22146
**Groer, P.G.,** Some remarks on exact methods for WL and $^{222}$Rn-daughter determination, 3:22172 (HASL—325, pp 34-36)
**Gros, M.,** Non-linear resonant mode coupling in a three-dimensional guiding centre water bag plasma, 3:22515
**Gross, D.A.,** *See* Akimov, Y., 3:22333
**Gross, T.,** *See* Job, C.A., 3:21684
**Grossman, L.M.,** *See* Ching, J.T., 3:21607
**Groves, W.O.,** *See* Coleman, J.J., 3:22064
**Gruber, R.P.,** Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster, 3:21279 (N—77-26222)
**Grudnikov, I.B.,** Production of paving asphalts from high-wax crudes in fuel-profile refineries, 3:21002
**Gruebler, W.,** Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering, 3:22338 (LA-tr—77-74)
**Grunder, H.A.,** Heavy-ion accelerators, 3:22099
**Grundl, J.A.,** *See* Fabry, A., 3:22378
**Grushko, J.S.,** *See* Alexandrov, A.J., 3:21239
**Guard, H.E.,** Fate of a bunker fuel in beach sand, 3:22211 (CONF-730386—, pp 827-834)
*See* Cobet, A.B., 3:22273
**Gubanova, G.D.,** *See* Gerber, V.Ya., 3:21009
**Gubrienko, K.I.,** *See* Baratov, D.G., 3:22110, 3:22116
**Gudiksen, P.H.,** *See* Colsher, C.S., 3:22201
**Guinn, K.R.,** *See* Johnson, B.C., 3:22036
**Guinn, V.P.,** Advance prediction of neutron activation analysis spectra and detection limits, 3:21928
**Gunion, J.F.,** Chiral symmetry breaking and the quark model: unification of baryon and meson constraints, 3:22352
**Gunn, S.R.,** *See* Glaros, S.S., 3:22649
*See* Rupert, V.C., 3:22428
**Gupta, A.B.,** *See* Secor, E.S., 3:20917
**Gupta, M.R.,** Parametric excitation of Langmuir waves in an inhomogeneous plasma, 3:22516
**Gupta, Y.P.,** *See* O'Neill, M.J., 3:21381
**Gurashvili, V.A.,** *See* Belykh, A.D., 3:21757
**Gurbanov, R.S.,** Investigation of the flow of an aqueous solution of polyacrylamide in narrow slots, 3:20975
**Gureev, A.A.,** Effect of oxygen concentration on the rate of liquid phase oxidation of jet fuels, 3:21059
**Gurevich, N.A.,** *See* Miroshnichenko, A.M., 3:20844
**Gurney, F.J.,** Summary report on investigation of metal processing operations. Final report 15 December 1973—22 March 1977, 3:21870 (AD-A—042188)
**Guseinov, S.O.,** Viscosity of liquid hexene-1 at high pressures, 3:21045
**Gusev, Yu.L.,** Tunable laser via $F^+_2$ and $F^-_2$ colour centers in the spectral region 0.88-1.25 μm, 3:22039
**Guseva, K.I.,** Systems of RF field stabilization and coherent-oscillation suppression in the linac first stage, 3:22113 (LA-tr—77-40)
**Guske, D.N.,** *See* Zagoruchenko, V.A., 3:21044
**Gusti, I.P.,** Results of tests of a prototype of the PE-600-300-2 feedwater pump, 3:21499
**Gutbrod, H.H.,** *See* Britt, H.C., 3:22364
**Gutowski, H.,** Procedures employed and future development trends for waste gas purification plants for light water reactors, 3:21624

## H

**Habegger, L.J.,** Long-term availability of water resources for energy development in the central United States, 3:21740 (CONF-7710101—5)
**Hadden, R.M.,** *See* Rainer, G., 3:21354
**Haga, K.,** *See* Kikuchi, Y., 3:21658
**Hagelstein, P.L.,** Review of photo-pumped short wavelength lasers, 3:22024 (UCID—17629)
**Hagemann, G.B.,** *See* Britt, H.C., 3:22364
**Hagenson, R.L.,** Reversed-field pinch reactor (RFPR), 3:22567
**Hagman, D.,** *See* Buck, J.V., 3:21415
**Hahn, O.J.,** *See* Fischer, J.R., 3:20871
**Haidue, M.,** *See* Szomodyi, A., 3:22336
**Haines, W.G.,** Effects of heat treatment on the optical and electrical properties of indium—tin oxide films, 3:21903
**Halbig, J.K.,** *See* Jameson, R.A., 3:22103
**Hales, W.L.,** *See* Jones, R.W., 3:22017
**Hall, C.F.,** *See* Colin, L., 3:22304
**Hall, I.J.,** *See* Boes, E.C., 3:21268
**Hall, J.R.,** *See* Job, C.A., 3:21684
**Hall, R.R.,** *See* Fennelly, P.F., 3:20929
**Hallet, R.W. Jr.,** Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108—8/2)
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108—8/3)
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem, 3:21320 (SAN/1108—8/4)
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem, 3:21321 (SAN/1108—8/5)
**Halligan, J.E.,** *See* Huffman, W.J., 3:21304
**Hambright, P.,** Equilibrium constants for the metalation of zinc porphyrins, 3:21963
**Hamilton, G.W.,** *See* Moir, R.W., 3:22623
**Hamm, R.W.,** Investigation of multi-charged heavy ion production in an electron beam ion source, 3:22114 (LA—7077-T)
**Hammond, P.R.,** Effect of laser dye deterioration on performance, 3:22037
**Hampel, V.E.,** General features of a scientific data base management system, 3:22697 (UCRL—80171)
**Hampl, E.F. Jr.,** Thermoelectric materials evaluation program. Quarterly technical task report No. 46, 3:21915 (MMM—2473-0422)
**Hamrick, J.T.,** Ignition process for downhole gas generator, 3:20960
**Hancock, O.,** *See* Chandra, S., 3:21364
**Hancock, O.G. Jr.,** Florida residential demonstration, 3:21337
**Hang, D.F.,** *See* Carbajo, J.J., 3:21604
**Hanley, D.W.,** Safety training as a means of reducing overexposures to radiographers, 3:22257
**Hanna, S.R.,** First annual report on weather modification effects of cooling towers, 3:22149 (TID—27836)
**Hansen, G.E.,** *See* Fabry, A., 3:22378

**Hansen, J.,** *See* Knollenberg, R.G., 3:22305
*See* Schubert, G., 3:22303
**Hansen, L.F.,** Laser driven fusion fission hybrids, 3:22539 (UCRL—79653)
**Hanson, G.,** *See* Perl, M.L., 3:22328
**Hara, K.,** Effect of pressure on the fluorescence and absorption of adamantanone, 3:21983
**Harboe, R.,** Determination of energy generation for a series of power stations connected in cascade, using a regression analysis, 3:21264
**Hardy, E.P.,** Analyses of quality control samples at EML and a contractor laboratory during 1977, 3:22143 (EML—334, pp I.15-I.36)
**Hardy, E.P. Jr.,** EML fallout program data, 3:22155 (EML—334, pp II.2-II.6)
Environmental Measurements Laboratory environmental quarterly, September 1—December 1, 1977, 3:22152 (EML—334)
**Hardy, J.C.,** *See* Cerny, J., 3:22384
**Hare, M.,** *See* Rump, W.M., 3:20953
**Harkness, S.D.,** *See* Brooks, J.N., 3:22676
**Harrar, J.E.,** General Chemistry Division quarterly report, July—September 1977, 3:21918 (UCID—15644-77-3)
**Harris, J.L.,** *See* Eraslan, A.H., 3:22229
**Harris, L., Jr.,** *See* Kull, L.A., 3:21226
**Harris, L.P.,** Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. Part 3: open cycle gas turbines and open cycle MHD. Final report, 3:21478 (N—77-26634)
*See* Bass, R.R., 3:21480
**Harris, W.B.,** Further development of the reinforced pillow solar water heater, 3:21365
**Hart, R.G.,** Sources, availability and cost of future energy, 3:21713 (AECL—5816)
**Harte, J.,** *See* Zimmerman, G., 3:22651
**Hartz, H.E.,** Drilling technique in the development of the North Sea's Forties Field, 3:20957
**Harvey, J.A.,** *See* Musgrove, A.R.L., 3:22365, 3:22366
**Hasegawa, A.,** Pseudo-three-dimensional turbulence in magnetized nonuniform plasma, 3:22508
*See* Mima, K., 3:22482
**Hasegawa, Y.,** Thermodynamic properties of lanthanide complexes with benzene-1,2-dioxydiacetic acid, 3:21961
**Haselton, H.H.,** PLT neutral particle injectors, 3:22625
*See* Schwenterly, S.W., 3:22684
*See* Stirling, W.L., 3:22615, 3:22626
**Hashimoto, K.,** Obliquely propagating whistler mode waves in cold plasmas permeated by dilute low-$\beta$ anisotropic plasmas, 3:22519
**Hassi, O.,** Sun as a source of energy in Finland, 3:21269
**Hastings, J.M.,** One-dimensional phonons and "phase-ordering" phase transition in a Hg-As-F compound, 3:21914
**Hatfield, J.R.,** Gas quality monitoring, 3:21070 (CONF-7603113—, pp E1-E9)
**Hattner, R.S.,** Nuclear medicine 1977: an assessment, 3:22241
**Hauer, A.,** *See* Yaakobi, B., 3:22440
**Hauptman, J.M.,** Experimental study of $\Lambda p$ and $\Xi^0 p$ interactions in the range 1-10 GeV/c, 3:22337
**Hauser, J.R.,** *See* Dunbar, P.M., 3:21285
**Hauseux, M.A.,** Mode of uranium occurrence in a migmatitic granite terrain, Baie Johan Beetz, Quebec, 3:21114
**Haws, L.D.,** *See* Collins, L.W., 3:22135
**Hayakawa, M.,** Mechanism of change with time of seismic wave speed (effect of water and heat), 3:21399
**Hayano, R.S.,** *See* Yamazaki, T., 3:22318
**Hayashi, S.A.,** *See* Nishihara, H., 3:21147
**Haycocks, C.,** Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April—June 1977, 3:20916 (FE—1231-9)
**Haynes, W.P.,** *See* Johnson, G.E., 3:20904
**Hays, E.F.,** Discrepancy in XC and oncogenicity assays for murine leukemia virus in AKR mice, 3:22245
**Hazle, A.J.,** What do we sample for and for how long, 3:22178 (HASL—325, pp 69-71)
**Head, C.R.,** *See* Coffman, F.E., 3:22559
**Heady, E.O.,** Agricultural energy modeling for policy purposes, 3:21718
**Heaps, J.D.,** *See* Zook, J.D., 3:21273
**Heath, L.J.,** Heavy oil recovery using solvents and explosives, 3:20949 (BERC/RI—77/16)
**Heath, R.L.,** *See* Reich, C.W., 3:22361
**Hebrank, J.,** HUD Utilities Demonstration Series. Volume 7. Performance analysis of the Jersey City total energy sits. Interim report, 3:21705 (PB—269517)
**Heck, F.M.,** EPR ohmic heating energy storage, 3:22605 (WFPS-TME—064)
**Hecker, R.,** *See* Kuijpers, L., 3:22581
**Hecker, W.,** *See* Meier, H., 3:21135
**Hedrick, C.L.,** *See* Nelson, D.B., 3:22476
*See* Uckan, N.A., 3:22537
**Heeb, C.M.,** ENFORM fuel cycle effluents model, 3:21204
*See* Kabele, T.J., 3:21203
**Heeger, A.J.,** *See* Hastings, J.M., 3:21914
**Heffner, J.D.,** Savannah River Laboratory Hydrogeochemical and Stream Sediment Reconnaissance. Preliminary raw data release: Spartanburg 1° x 2° NTMS area, North Carolina and South Carolina. National Uranium Resource Evaluation Program, 3:21118 (DPST—77-146-2)
**Hegerhorst, K.B.,** Impedance calculations for power cables to primary coolant pump motors, 3:21562 (LTR—1310-17)
**Heil, T.J.,** Principal aspects of converting steam generators back to coal, 3:21810 (CONF-770658—, pp 149-176)
**Heinrich, L.A.,** Safetguards planning in a plant design process, 3:21228
**Heinrich, R.R.,** Dosimetry needs for the Magnetic Fusion Materials Program, 3:22677 (CONF-771036—6)
**Heinzel, F.,** Analysis of animal experiments of radiation dependent tumor regression in relation to different parameters, 3:22261 (LA-tr—77-73A)
**Heisler, G.M.,** *See* Herrington, L.P., 3:21544
**Helt, M.,** Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis, 3:22276 (EML—334, pp I.69-I.90)
**Helfand, R.M.,** *See* Brown, R.D., 3:21730
**Helmer, R.G.,** Decay of $^{128}$Cs, 3:22359 (TREE—1115, pp 3-10)
Decay of $^{150}$Tb, 3:22368 (TREE—1115, pp 21-27)
*See* Greenwood, R.C., 3:22360
*See* Reich, C.W., 3:22361
**Hemminger, J.C.,** *See* Muetterties, E.L., 3:21953
**Hendricks, C.D.,** *See* Woerner, R.L., 3:21236
**Hendrie, D.L.,** *See* Gelbke, C.K., 3:22374
**Henrich, E.,** Chemistry of nuclear waste disposal, 3:21194
**Henry, C.N.,** *See* Dowdy, E.J., 3:21234
**Henshall, G.D.,** (GaAl)As—GaAs heterostructure lasers: factors affecting catastrophic degradation, 3:22057
**Heppert, J.A.,** Evaluation of the photochemical production of hydrogen from solar energy, 3:21313 (UCID—17535)
**Herakovich, E.T.,** *See* Kennedy, J.M., 3:21908
**Herb, S.W.,** *See* Kephart, R.D., 3:22334
**Hermes, W.L.,** *See* Berkowitz, M., 3:21854
**Herr, K.C.,** *See* Grimmer, D.P., 3:21378
**Herrington, L.P.,** Microclimate modification due to power transmission rights of way, 3:21544
**Herrman, W.,** Effect of material constitutive models on stress wave propagation calculations, 3:22003
**Herrmann, G.,** Electric power transport or coal transport - where to build new stone coal power plants, 3:21528
**Herskind, B.,** *See* Britt, H.C., 3:22364
**Hervey, G.H.,** *See* O'Hara, J.B., 3:20877
**Herzenberg, C.,** *See* Duffey, D., 3:21924
**Herzenberg, C.L.,** Neutron induced gamma spectrometry for on-line compositional analysis in coal conversion and fluidized-bed combustion plants, 3:20887 (CONF-771072—3)
**Herzing, R.,** *See* Kuijpers, L., 3:22581
**Herzog, A.H.,** *See* Coleman, J.J., 3:22064
**Hessler, J.P.,** *See* Jacobs, R.R., 3:21965
**Hett, W.,** *See* Blattman, H., 3:22263
**Hewig, G.H.,** *See* Schock, H.W., 3:21287
**Hey, J.D.,** Thermal equilibrium in plasmas containing negative ions. II, 3:22444
**Hickey, J.W.N.,** Radiological effluent and environmental monitoring for uranium mills: a regulatory viewpoint, 3:22197
**Hidaka, H.,** Suggestion for a dibaryon resonance in the pp system, 3:22342
**Higginson, G.S.,** *See* Aiken, J., 3:22432
**Hill, A.H.,** Recovery of zinc chloride catalyst from coal hydrogenation char, 3:20882
**Hill, D.,** *See* Auer, I.P., 3:22335
**Hill, J.,** Nuclear power generation, 3:21600
**Hill, J.D.,** *See* Ollila, R.G., 3:21801
**Hill, J.M.,** Enhancement of flat plate solar collector performance through the use of planar reflectors, 3:21380
**Hill, R.N.,** Differential toxicity of chloroform in the mouse, 3:22278
**Hill, Z.,** *See* Antic, S., 3:21004
**Hillis, D.L.,** *See* Britt, H.C., 3:22364
**Hillman, P.E.,** *See* Huffman, W.J., 3:21304
**Hilsum, C.,** Gallium arsenide and related compounds (Edinburgh), 1976, 3:22056
**Himmel, G.,** Investigation of particle velocities in a 'critical velocity' rotating plasma, 3:22452
**Hintz, N.M.,** *See* Blanpied, G.S., 3:22354
**Hirai, G.,** *See* Tabuchi, A., 3:22258
**Hirota, A.,** *See* Ouchi, K., 3:20885
**Hirshfield, J.L.,** Cyclotron masers (gyrotrons) as potent millimetre-wave sources, 3:22409
**Hirshman, S.P.,** *See* Gelbard, E.M., 3:22460
**Hisamasu, T.,** Process for the treatment of flue and waste gases, 3:20908
**Hishinuma, Y.,** Process for the removal of nitrogen oxides from flue gas, 3:20906
**Hite, R.J.,** Subsurface geology of a potential waste emplacement site, Salt Valley Anticline, Grand County, Utah, 3:21183 (USGS-OFR—77-761)
**Hively, L.M.,** Sensitivity studies on 3.5-MeV alpha bombardment of tokamak first wall, 3:22589

**Hlavin, A.C.,** Terraset: taking less from the Earth, 3:21353
**Hockenbury, R.W.,** Reliability course for nuclear engineering students, 3:21605
**Hodgett, D.,** *See* Jones, P.L., 3:21836
**Hodgson, R.L.,** *See* Davis, C.E., 3:21034
**Hodkinson, P.H.,** Failure analysis of pressure vessels with defects. Progress report, September 1976, 3:21640 (N—77-26550)
**Hoekzema, J.A.,** Screw pinch approach to controlled fusion, 3:22454 (INIS-mf—3355)
**Hoering, M.,** *See* Donath, E.E., 3:20883
**Hoffman, A.,** Status of laser solenoid fusion concept, 3:22569
**Hoffman, A.S.,** *See* Ratner, B.D., 3:22250
**Hoffman, C.J.,** *See* Perry, D.G., 3:22118
**Hoffman, F.O.,** Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208
**Hoffman, G.W.,** *See* Blanpied, G.S., 3:22354
**Hoffman, K.C.,** Metal hydride storage for mobile and stationary applications, 3:21255
**Hofman, M.Z.,** International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889—)
**Holcomb, W.F.,** Summary of shallow land burial of radioactive wastes at commercial sites between 1962 and 1976, with projections, 3:21192
**Holden, N.E.,** *See* Burrows, T.W., 3:22290
**Holden, S.C.,** Slicing of silicon into sheet material. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Sixth quarterly report, June 18, 1977—September 18, 1977, 3:21274 (ERDA/JPL/954374—77/3)
**Holden, T.M.,** *See* Buyers, W.J.L., 3:21901
**Holdren, M.,** *See* Rasmussen, R.A., 3:22145
**Holliden, G.A.,** TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January—September 1976, 3:21525 (PB—269850)
**Holling, H.P.,** Effect of concentrations of water/fuel oil emulsions on the total emission of solid particles from oil fired boilers, 3:21058
**Holloway, F.W.,** *See* Bliss, E.S., 3:22652
**Holmes, J.A.,** *See* Peng, Y-K.M., 3:22561
**Holmstrom, H.L.O.,** *See* White, J.R., 3:21646
**Holonyak, N. Jr.,** *See* Coleman, J.J., 3:22064
**Holt, S.,** *See* Swank, J., 3:22296
**Holub, R.F.,** *See* Droullard, R.F., 3:22175
**Holzrichter, J.F.,** *See* Rupert, V.C., 3:22428
**Hom, D.C.,** *See* Kephart, R.D., 3:22334
**Homonnay, G.,** Long-distance heating systems, 3:21706
**Hontzeas, S.A.,** *See* Rowson, J.W., 3:21934
**Hooper, E.B. Jr.,** High energy negative deuterium beams using double charge-exchange or surface production, 3:22621 (UCRL—80406)
**Hoover, L.J.,** *See* Habegger, L.J., 3:21740
**Hooverman, R.H.,** Rotary kiln gasification of biomass and municipal wastes, 3:21303 (CONF-770235—, pp 23p, Paper 1)
**Hora, H.,** Advanced fuel nuclear reaction feasibility using laser compression. I, 3:22658
*See* Castillo, R., 3:22657
*See* Ray, P.S., 3:22585
**Horgan, D.N. Jr.,** *See* Badertscher, N.L., 3:22558
**Horikawa, K.,** Concentration and quantitative determination of trace volatile fatty acids in water by liquid chromatography with thermal detector, 3:21931 (BNWL-tr—279)
**Horton, T.R.,** Estimation of $^{222}Rn$ daughter doses from large-area sources, 3:22195
**Hosea, J.C.,** *See* Brusati, M., 3:22449
**Hosker, R.P. Jr.,** *See* Hanna, S.R., 3:22149
**Hotchkiss, W.T.,** *See* Gallagher, J.G., 3:21662
**Houlberg, W.A.,** *See* Peng, Y-K.M., 3:22561
**Houssin, B.,** *See* Cadiou, L., 3:21564
**Houston, J.E.,** *See* White, J.M., 3:21966
**Hovingh, J.,** First wall costs of an ion-beam fusion reactor, 3:22642 (UCID—17555)
**Howard, J.E.,** *See* Moses, G.A. Conn, R.W., 3:22669
**Howe, L.H.,** Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76, 3:22212 (PB—269652)
**Howland, H.R.,** *See* Jedruch, J., 3:22630
**Hruby, V.,** *See* Demirjian, A., 3:21752
**Hruska, A.,** Containment of an adiabatic plasma on magnetic lines of force by a self-generated electrostatic field, 3:22410
**Hsieh, J.J.,** *See* Rossi, J.A., 3:22063
**Hsieh, S.Y.,** *See* Majumdar, D., 3:22632
**Hsuan, H.C.S.,** *See* Lonngren, K.E., 3:22400
**Huang, C.Y.,** *See* Yamazaki, T., 3:22318
**Huba, J.D.,** Nonlinear stabilization of the lower-hybrid-drift instability by electron resonance broadening, 3:22487
**Hubbard, J.L.,** *See* Stoll, G.J., 3:21602
**Hudson, W.T.,** Installation and testing of a solar heating system for an aquatic recreational facility, 3:21345
Installation and operation of solar heating system for the Hooker Barnes solar home, 3:21350
*See* Debs, A.S., 3:21344
*See* Lindsay, W., 3:21347
*See* McCloud, W.T. II, 3:21348
*See* Reihl, J.D., 3:21349
*See* Williams, J.R., 3:21346, 3:21707
**Huempfner, R.A.,** Recapturing radio-tagged ruffed grouse by nightlighting and snow-burrow netting, 3:22209
**Huff, J.E.,** *See* Waters, E.M., 3:21984
**Huffman, W.J.,** Application of SGFM technology to other feedstocks: status report, 3:21304 (CONF-770235—, pp 55p, Paper 3)
**Huguenin, P.,** *See* Corfu, R., 3:22367
**Huizenga, J.R.,** *See* Schroeder, W.U., 3:22382
**Hunt, C.M.,** *See* Burch, D.M., 3:21785
**Hunter, S.C.,** Field testing: application of combustion modifications to control pollutant emissions from industrial boilers. Phases I and II (data supplement). Supplemental report for June 1973—September 1975, 3:22092 (PB—270112)
**Hunter, T.O.,** Temperature and displacement transients in inertial confinement fusion first walls, 3:22671
**Huntz, A.M.,** *See* Lesage, B., 3:21891
**Hurley, C.A.,** *See* Manes, K.R., 3:22647
**Hurley, C.W.,** *See* Hebrank, J., 3:21705
**Hurtubise, R.J.,** *See* Schabron, J.F., 3:20893
**Hussung, R.O.,** *See* Corwin, W.R., 3:22682
**Hutchinson, D.P.,** *See* Barnett, C.F., 3:22419
**Hutchinson, P.W.,** *See* Dobson, P.S., 3:22060
**Hwang, S.C.,** Dew-point loci for methane—toluene system, 3:21256 (CONF-770375—, pp 42-44)

## I

**Iacovino, J.M. Jr.,** Financing nuclear power plant pollution controls, 3:21620
**Ibragimov, S.M.,** *See* Kerimov, A.A., 3:20943
**Ibrahimpasic, I.,** *See* Antic, S., 3:21004
**Idsinga, W.,** Assessment of two-phase pressure drop correlations for steam-water systems, 3:21559
**Igo, G.,** *See* Blanpied, G.S., 3:22354
**Iguchi, H.,** Observations of cyclotron radiations from turbulently heated plasmas (the MACH II), 3:22407
**Iijima, T.,** *See* Shirakata, K., 3:21626
**Ikegami, S.,** *See* Yamaguchi, K., 3:21286
**Il'yasov, A.Z.,** *See* Arifov, P.U., 3:21898
**Illingworth, R.,** *See* Brown, R., 3:22433
**Imanaka, T.,** *See* Suzuki, H., 3:21576
**Imanov, E.G.,** *See* Elkin, V.M., 3:21010
**Imazato, J.,** *See* Yamazaki, T., 3:22318
**Innes, W.R.,** *See* Kephart, R.D., 3:22334
**Inoue, T.,** Outline of heat cycles and facilities for geothermal power generation, 3:21439
**Inushima, H.,** *See* Kikuchi, Y., 3:21592
**Ioakimis, E.G.,** *See* Gerber, V.Ya., 3:21009
**Ionin, D.A.,** Statistical method of locating gas leaks along a gas pipeline route, 3:21095
**Irie, M.,** Flow velocity measurement in high-current arcs using Doppler-shifted plasma scattering, 3:22435
**Irving, J.,** *See* Brown, R., 3:22433
**Irwin, H.S.,** Historical and legal aspects of transmission lines, 3:21547
**Isakov, A.I.,** *See* Gribkov, V.A., 3:22415
**Isao, K.,** Continuous hydrogen production by immobilized whole cells of Clostridium butyricum, 3:21251
**Iseki, T.,** *See* Suzuki, H., 3:21576
**Ishii, K.,** *See* Kusuda, T., 3:21267
**Isidoro, R.J.,** Data aquisition and processing system, 3:22129 (SAND—77-1914C)
**Ismailov, I.,** Characteristics of n-GaP/sub x/As/sub 1-x/—p-Ga/sub 1-y/Al/sub y/P/sub x/As/sub 1-x/ heterojunction lasers emitting visible radiation, 3:22053
**Ito, A.S.,** *See* Kephart, R.D., 3:22334
**Ito, J.,** *See* Smyth, J.R., 3:21455, 3:21967
*See* Yora, M., 3:21402
**Ito, Y.,** *See* Iguchi, H., 3:22407
**Itoh, H.,** *See* Ouchi, K., 3:20885
**Ivanov, G.V.,** *See* Sharkov, V.F., 3:22054
**Ivanov, N.V.,** *See* Shmukler, B.I., 3:21493
**Ivanov, S.N.,** *See* Rabinovich, A.V., 3:21502
**Ivashev, V.D.,** *See* Rabinovich, A.V., 3:21502
**Iwata, H.,** *See* Tagawa, T., 3:21445
**Iwinski, E.M.,** *See* Sink, D.A., 3:22544

## J

**Jackson, D.R.,** Cd ion activity in soils: evaluation of Cd ion-selective electrode, 3:21930
**Jackson, R.D. Jr.,** Offshore oil pollution: law and enforcement, 3:21021
**Jacobs, K.,** Almost-periodic Markov processes, 3:22696 (UCRL-Trans—11303)
**Jacobs, K.M.,** Energy usage and other comparisons between gasoline and diesel medium duty trucks, 3:21852
**Jacobs, R.R.,** Deactivation on the $Nd^{3+}$,$^4F$/sub 3/2/ level in neodymium chloride—aluminum chloride vapor complexes, 3:21965

*See* Prosnitz, D., 3:22028
**Jacobson, D.L.,** Material selection considerations for fluoride thermal energy storage containment in a sodium heat pipe environment. Final report 1 June—August 1976, 3:21671 (AD-A—042389)
**Jacobson, R.A.,** *See* Templeton, J.L., 3:21952
**Jacoby, C.H.,** Scoping report on various salt mines in the United States, 3:21184 (Y/OWI/SUB—77/16523/2)
**Jacson, M.,** Production and testing of tubes for nuclear boiler steam generators, 3:21566
**Jain, K.C.,** *See* Sahu, R.P., 3:21877
**Jakobs, R.,** *See* Kruse, H., 3:21781
**Jakobson, M.J.,** Total pion cross section measurements. Annual progress report, January 1, 1975—December 31, 1975, 3:22358 (RLO—2232-T1-4)
**James, L.A.,** *See* Archer, V.E., 3:21209
**Jameson, R.A.,** LAMPF 201.25-MHz linac field distribution, 3:22103 (LA—6919)
**Jansen, P.,** *See* Begemann, S.H.A., 3:21298
**Janson, T.R.,** *See* Katz, J.J., 3:21308
**Jardin, S.C.,** Stabilization of the axisymmetric instability in the PDX tokamak, 3:22478 (PPPL—1400)
**Jarriel, J.L.,** *See* Pellarin, D.J., 3:22011
**Jassby, D.L.,** *See* Cohn, D.R., 3:22600
**Javeri, V.,** Combined influence of Hall effect, ion slip and temperature boundary condition of third kind on MHD channel flow heat transfer, 3:21766
**Jedruch, J.,** Physics of tritium breeding as a geometric programming problem, 3:22630 (WFPS-TME—068)
**Jeffery, P.G.,** *See* Cormack, D., 3:21030
**Jenkins, E.,** *See* Akimov, Y., 3:22333
**Jenkins, J.D.,** *See* McNeany, S.R., 3:21144
**Jenkins, N.,** World Energy Conference reveals Soviet energy strategy, 3:21693
**Jensen, C.L.,** Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T—778)
**Jensen, G.F.,** Home energy savers program: a little time can save a lot of money, 3:21709 (TID—28047)
**Jensen, R.N.,** *See* Boyle, R.J., 3:21370
**Jeppesen, R.H.,** *See* Jakobson, M.J., 3:22358
**Jeppson, M.R.,** Electrical power generation and distribution system, 3:21532
**Jerabek, P.A.,** *See* Volborth, A., 3:20888
**Jessup, B.I.,** *See* Brennan, M.H., 3:22436
**Jester, W.A.,** Comparison of the bromide ion and iodide ion neutron activable tracers with tritiated water as groundwater tracers, 3:22218
**Jeter, S.M.,** *See* Leonaitis, L.L., 3:21351
**Job, C.A.,** Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report, 3:21684 (PB—271104)
**Joestlein, H.,** *See* Kephart, R.D., 3:22334
**Joffre, R.,** Electric purification of gases, 3:21835
**Johnson, B.C.,** Optical rise-time measurements on KD*P transmission-line Pockels cells, 3:22036
**Johnson, C.J.,** Inhalation of dust contaminated with plutonium: Possible health effects. Health considerations of proposed residential development of land contaminated with plutonium in the Denver area, 3:21210 (HRP—0006798)
**Johnson, D.H.,** Electrochemical cell, 3:21673
**Johnson, D.J.,** Spatially resolved EUV emission from focused REB discharges into thin targets, 3:22427
**Johnson, D.O.,** *See* Bogner, J.E., 3:20911
**Johnson, E.F.,** Chemical engineering side of nuclear fusion power, 3:22554
**Johnson, F.S.,** *See* Heath, L.J., 3:20949
**Johnson, G.B.,** *See* Kaye, R.J., 3:22617
**Johnson, G.E.,** Treatability studies of condensate water from Synthane coal gasification, 3:20904 (PERC/RI—77/13)
**Johnson, G.G.,** *See* Brown, D.H., 3:21479
*See* Corman, J.C., 3:21476
**Johnson, H.D.,** Mechanical properties of LX-10-1. Process Development Endeavor No. 105, 3:22134 (MHSMP—77-58)
**Johnson, J.E. Jr.,** View on techniques of preparation of cell and tissue culture specimens for electron microscopy, 3:22233 (LBL—5638)
**Johnson, L.C.,** *See* Schuss, J.J., 3:22420
**Johnson, L.P.,** *See* Haycocks, C., 3:20916
**Johnson, M.M.,** Process for separation and recovery of carbon monoxide, 3:22094
**Johnson, P.L.,** *See* Maffly, R.L., 3:21970
**Johnston, W.D. Jr.,** Growth and characterization of VPE thin-film AlAs—GaAs heterojunction layers, 3:21300
**Jolly, W.L.,** *See* Yang, D.J., 3:21958
**Jonasson, I.R.,** *See* Coker, W.B., 3:21130
**Jones, C.W.,** *See* Jones, R.C. Jr., 3:21639
**Jones, D.S.,** *See* Ralston, D., 3:20881
**Jones, G.T.,** Development of low-cost, high energy-per-unit-area solar cell modules. Quarterly report No. 3, July 1, 1977—September 30, 1977, 3:21277 (ERDA/JPL/954605—77/3)
**Jones, I.R.,** *See* Brennan, M.H., 3:22436
**Jones, O.E.,** Physical protection safeguards for nuclear materials and facilities, 3:21225
**Jones, P.L.,** Radio frequency drying of papers and textiles, 3:21836
**Jones, R.A.,** *See* Heath, L.J., 3:20949
**Jones, R.C. Jr.,** One-Third-Scale Air—Water Pump Program, LOCA and pump overspeed analyses. Final report, 3:21639 (EPRI-NP—474)
**Jones, R.W.,** Medium homogeneity in a chemical laser cavity using a lateral shearing interferometer. Technical report, 3:22017 (AD-A—042504)
**Jones, V.W.,** Fundamentals of gas treating, 3:21071 (CONF-7603113—, pp F1-F30)
**Jongsma, D.,** Structure of the Naturaliste Plateau and Trough, 3:20944
**Joss, P.C.,** Analysis of "noise" in the rich absorption-line spectra of quasars. I. Method of scrambled standard lines, 3:22300
**Jovanovic, M.,** *See* Antic, S., 3:21004
**Judd, B.T.,** Methanol from natural gas for engine fuel. 2nd interim report. Report No. 23, 3:21868 (NP—22771)
**Judd, D.L.,** *See* Faltens, A., 3:22639
**Judge, A.S.,** Geothermal studies in the MacKenzie Valley by the Earth Physics Branch, 3:21411
**Juentgen, H.,** Development trends in coal gasification, 3:20866
**Julian, Y.,** *See* Mason, D.M., 3:20850
**Jumel, Y.,** Electrochemical generator, 3:21675
**Jung, T.H.,** *See* Pick, J.B., 3:21416
**Jung, W.,** Process and equipment employed in the vaporisation and conditioning units of the Nievenheim LPG plant, 3:21078
Process and machine technology used in vaporization and conditioning units of Nievenheim Liquefied Natural Gas Plant, 3:21079
**Jungwirth, K.,** Convective excitation of quasistatic waves in an inhomogeneous anisothermic plasma. II. Nonlinear estimates, 3:22527
**Just, L.,** *See* Szomodyi, A., 3:22336
**Justi, E.,** Cover for solar energy collectors, 3:21368

## K

**Kaae, J.L.,** *See* Pollmann, E., 3:21145
**Kabadi, J.N.,** *See* Greywall, M.S., 3:22528
**Kabele, T.J.,** Effluents from the LWR stowaway fuel cycle, 3:21203
**Kachen, G.I.,** *See* Donaldson, T.P., 3:22434
**Kadyk, J.A.,** *See* Hauptman, J.M., 3:22337
**Kaelin, R.,** Lowering heat consumption by means of infrared mirror coating of windows, facades and roofs, 3:21786
**Kaesberg, P.,** *See* Shih, D.S., 3:22231
**Kahlert, G.,** Waste burner overfire draft system, 3:21842
**Kahn, H.,** *See* Brown, W.M., 3:21723
**Kaji, N.,** *See* Mochida, I., 3:20985
**Kaji, R.,** *See* Hishinuma, Y., 3:20906
**Kakihana, H.,** Method for separation and enrichment of isotopes, 3:21142
**Kal'chenko, V.I.,** *See* Kostyuk, V.I., 3:21016
**Kalinin, B.A.,** *See* Bazarov, B.A., 3:21373
**Kalmaz, E.V.,** *See* Eraslan, A.H., 3:22216
**Kalus, D.,** Energy management in modern hospitals, 3:21795
**Kalygin, A.G.,** *See* Es'kov, A.G., 3:22601
**Kameyama, T.,** *See* Dokiya, M., 3:21249, 3:21250
**Kaminsky, M.,** *See* Sinha, M.K., 3:21896
**Kammash, T.,** *See* Spong, D.A., 3:22491
**Kane, E.L.,** *See* Castillo, R., 3:22657
**Kane, R.S.,** Scaling laws and the differential equations of an entrained flow coal gasifier, 3:20863
**Kanter, H.J.,** *See* Reiter, R., 3:22191
**Kapelyushnikov, V.M.,** *See* Bazarov, B.A., 3:21373
**Kapetanakos, C.,** *See* Sprangle, P., 3:22098
**Kapitza, P.L.,** Global problems and energy, 3:21696
**Kaplan, D.,** *See* Cohn, D.R., 3:22600
**Kaplan, D.M.,** *See* Kephart, R.D., 3:22334
**Kapron, H.,** Dependence of current density and intensity of electric field on pulsation of thermodynamic parameters of plasma in a MHD generator, 3:21756
**Kapur, V.K.,** Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977—July 31, 1977, 3:21276 (ERDA/JPL/954471—77/3)
**Karam, R.A.,** Pressure vessel question, 3:21667
**Karas', V.I.,** Role of electronic excitations with energy distribution in local nonequilibrium in increasing T/sub c/, 3:22394
**Karazeeva, L.P.,** *See* Bibikov, G.G., 3:21017
**Karazinova, K.G.,** *See* Kipnis, Sh.Sh., 3:20898
**Kargapol'sev, V.S.,** *See* Basov, N.G., 3:22051
**Karnaukh, G.S.,** *See* Kostyuk, V.I., 3:21016
**Karnaukh, N.P.,** *See* Borisov, B.N., 3:22049
**Karnaukhov, I.M.,** *See* Derkach, A.Y., 3:22009
**Karraker, D.G.,** Moessbauer spectra of Np(V)—Cr(III) and Np(V)—Rh(III) complexes, 3:21962
**Karttunen, J.O.,** Cesium-137 in various Chicago foods (collection month: October 1977), 3:22204 (EML—334, pp III.3-III.6)
**Kartvelishvili, V.G.,** Relative yield of D mesons in hadronic collisions, 3:22346
**Kasha, H.,** *See* Grannan, D.M., 3:22331
**Kashiwagi, H.,** *See* Yamashita, M., 3:21143
**Kasner, W.H.,** *See* Rogoff, G.L., 3:22018
**Kastenberg, W.E.,** Reactor safety in the nucelar engineering program at UCLA, 3:21665
**Kastner, S.O.,** On three-dimensional reconstruction of optically thin solar emission sources, 3:22299 (N—77-27056)

**Kasumbekova, Z.M.,** *See* Mamedov, F.A., 3:20966
**Kato, H.,** *See* Robertson, T.L., 3:22246, 3:22247
**Katrasev, V.V.,** *See* Ageev, A.I., 3:22107
**Kats, G.,** *See* Thompson, C.R., 3:22249
**Katsube, Y.,** *See* Tabuchi, A., 3:22258
**Katsuki, M.,** Experimental study on the emissions of a model gas turbine combustor, 3:21866
Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission, 3:21867
**Katz, J.J.,** Biomimetic approach to solar energy conversion, 3:21308 (CONF-770582—1)
**Kaufman, H.A.,** State-of-the-art of functional use data measuring energy consumption in the commercial sector. Final report, 3:21797 (PB—269906)
**Kaufman, L.,** Polarized radiation for XRF of elements with Z=47-57, 3:21939
**Kaul, B.K.,** *See* Donohue, M.D., 3:21040
**Kaundinya, H.,** *See* Relotius, P.C., 3:21056
**Kaushik, S.C.,** *See* Tewari, D.P., 3:22493
**Kautz, R.L.,** Picosecond pulses on superconducting striplines, 3:22007
**Kawabe, T.,** *See* Iguchi, H., 3:22407
**Kaye, R.J.,** Focussing of an ion beam from a reflex triode, 3:22617 (COO—2765-7)
**Kazachkov, A.A.,** *See* Bortnikov, A.V., 3:22555
**Kazimi, M.S.,** *See* Sawdye, R., 3:22633
**Keefe, D.,** *See* Faltens, A., 3:22639
**Keene, W.,** *See* Battist, L., 3:22122
**Keilmann, F.,** Tunable-laser-induced grating dip for measuring sub-picosecond relaxation, 3:21916
*See* Gondhalekar, A., 3:22441
**Kelin, G.E.,** *See* Troyanovskii, B.M., 3:21611
**Keller, J.H.,** *See* Dyer, N.C., 3:21623
**Keller, O.L. Jr.,** Chemistry of the transactinide elements, 3:22310
**Kellogg, L.S.,** *See* Fabry, A., 3:22378
**Kellogg, R.G.,** *See* Grannan, D.M., 3:22331
**Kelly, B.T.,** Technology and assessment of neutron absorbing materials, 3:21884 (TRG-Report—2953(S))
**Kelly, W.L.,** *See* Kruger, G.B., 3:21578
**Kelso, T.M.,** *See* Holliden, G.A., 3:21525
**Kemp, A.H.,** Glycol dehydration of natural gas containing $H_2S$ and $CO_2$, 3:21072 (CONF-7603113—, pp G1-G10)
**Kendrick, H.,** *See* Claridge, D.E., 3:22226
**Kennedy, H.T.,** *See* Wiesepape, C.F., 3:21039
**Kennedy, J.E.,** *See* Nunziato, J.W., 3:22136
**Kennedy, J.M.,** Influence of temper condition on the nonlinear stress—strain behavior of boron—aluminum. Interim report, March—October 1976, 3:21908 (N—77-26271)
**Kennedy, W.E.,** *See* Kabele, T.J., 3:21203
**Kephart, R.D.,** Measurement of the dihadron mass continuum in p-Be collisions and a search for narrow resonances, 3:22334
**Kerimov, A.A.,** Period of formation of rupture faults in the kyurovdag area section, 3:20943
**Kerimov, K.M.,** *See* Kerimov, A.A., 3:20943
**Kerimov, Z.G.,** Determination of the service life of drill pipes according to the cyclic strength criterion, taking account of loadings during lifting and sinking operations, 3:20970
**Kerlin, T.W.,** *See* Robertson, F.R., 3:21569
**Kershaw, D.,** *See* Zimmerman, G., 3:22651
**Kessler, G.,** Insulating spacer for double insulated glass, 3:21775
**Kessler, R.,** *See* Becker, F.E., 3:21753
**Ketterson, J.B.,** *See* Roach, P.D., 3:22325
**Ketzlach, N.,** *See* Clayton, E.D., 3:21215
**Keune, D.L.,** *See* Coleman, J.J., 3:22064
**Keusch, F.,** *See* Baarli, J., 3:22253
**Kevan, L.,** *See* Narayana, P.A., 3:21993
**Khairallah, A.,** *See* Bouteau, F., 3:22389
**Khalikov, G.A.,** Oil displacement under elastic operating conditions, 3:20973
**Khalil, E.E.,** Calculation of radiative heat transfer in a large gas fired furnace, 3:22089
**Kharlampovich, G.D.,** *See* Oblasova, L.Z., 3:21054
**Khodak, V.D.,** *See* Kostyuk, V.I., 3:21016
**Khodzhaev, A.Sh.,** *See* Zakhidov, R.A., 3:21374
**Khokhlov, L.K.,** *See* Mostinskii, I.L., 3:21761
**Kholin, I.V.,** *See* Basov, N.G., 3:22044
**Kholodenko, M.A.,** *See* Afonin, A.G., 3:22117
*See* Baratov, D.G., 3:22116
**Khrabrov, P.V.,** *See* Marchenko, Yu.A., 3:21497
**Khristich, L.M.,** *See* Parshin, A.A., 3:21492
**Khromykh, A.M.,** *See* Nazarenko, M.M., 3:22043
**Khudyakov, S.A.,** *See* Grigor'ev, E.I., 3:21301
**Khukhareva, I.S.,** *See* Borka, S., 3:21875, 3:21889
**Kiessling, F.,** New 380 kV lines constructed by the Bayernwerk AG, 3:21551
**Kikitin, V.V.,** *See* Basov, N.G., 3:22051
**Kikuchi, Y.,** Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle, 3:21592 (JAPFNR—263)
Transient boiling of sodium in a 19-pin bundle under loss-of-flow conditions, 3:21658 (JAPFNR—262)
**Kilby, J.S.,** Solar energy conversion, 3:21314
**Kildal, H.,** Efficient high energy infrared third harmonic generation in gases and liquids for laser fusion applications. Quarterly progress report, September 1, 1977—November 30, 1977, 3:22019 (COO—4251-4)
Efficient third harmonic generation of $CO_2$ laser radiation in liquid CO—$O_2$—$SF_6$ mixtures, 3:22637 (COO—4251-5)
Infrared four-wave sum and difference frequency generation in liquid CO-$O_2$ mixtures, 3:22032
**Kilkenny, J.,** Geysers geothermal field, 3:21393
**Kim, K.H.,** *See* Eraslan, A.H., 3:22229
**Kim, S.H.,** *See* Wang, S.T., 3:22593
**Kimmel, D.R.,** *See* Bailey, L.L., 3:21851
**Kimura, I.,** *See* Hashimoto, K., 3:22519
*See* Nishihara, H., 3:21147
**Kinderman, A.J.,** Computer methods for sampling from student's t distribution, 3:22695
**King, E.I.,** *See* Heck, F.M., 3:22605
**King, P.W.,** *See* Young, R.T., 3:21912
**Kingsep, A.S.,** *See* Gorev, V.V., 3:22532
**Kionka, U.,** *See* Stoy, B., 3:21788
**Kipnis, Sh.Sh.,** Optimum conditions for the fractional analysis of <1 mm coal samples, 3:20898
**Kirch, H.J.,** *See* Benndorf, H., 3:21534
**Kirchmayr, R.,** Flame resistance for plastics and chemical fibers, 3:22076
**Kirillov, V.V.,** *See* Beloglazov, A.A., 3:21768
**Kirkby, P.A.,** *See* Pion, M., 3:22059
**Kirsanov, V.P.,** *See* Borisov, B.N., 3:22049
**Kiselewich, S.J.,** Flow-coordinated operating strategies for automated transportation systems, 3:21806
**Kitamura, T.,** *See* Hisamasu, T., 3:20908
**Kittinger, W.D.,** *See* Medina, L.C., 3:22281
**Kiyose, R.,** *See* Clayton, E.D., 3:21215
**Klabunde, K.J.,** *See* Ralston, D., 3:20881
**Klein, A.S.,** *See* Untermyer, S., 3:22202
**Klein, O.,** *See* Littman, F.E., 3:22146
*See* Stejskal, J., 3:21177
**Kleinsmith, P.E.,** Multiple spatial scaling and the weak coupling approximation. II. Homogeneous kinetic equation, 3:22466
**Klemin, A.I.,** *See* Emel'yanov, I.Ya., 3:21597
**Klemm, H.,** *See* Fennelly, P.F., 3:20929
**Klepeis, J.E.,** *See* Becker, F.E., 3:21753
*See* Demirjian, A., 3:21752
**Klima, R.,** Quasi-linear relaxation of runaway electrons in a hf heated tokamak plasma, 3:22414
**Klimkin, V.M.,** Tunable single-frequency calcium—hydrogen laser emitting at 5.54 μ, 3:22052
**Kline, L.E.,** *See* Rogoff, G.L., 3:22018
**Kluge, W.,** *See* Appel, H., 3:22111
**Klumper, L.,** *See* Sweitser, D., 3:21911
**Klushin, Yu.A.,** *See* Dorokhov, E.V., 3:21537
**Knaus, S.E.,** *See* Kowal, K., 3:21588
**Kneubuehl, F.,** *See* Kaelin, R., 3:21786
**Knight, G.B.,** Radiation surveys in contaminated communities, 3:22179 (HASL—325, pp 73-77)
**Knoepfel, H.,** *See* Zweben, S.J., 3:22455
**Knoll, R.H.,** *See* Boyle, R.J., 3:21370
**Knollenberg, R.G.,** Clouds of Venus, 3:22305
**Knutsen, C.A.,** Benefits of stimulating geothermal energy development with tax and research subsidies, 3:21422
**Knutson, E.O.,** Ventilation measurements as an adjunct to radon measurements in buildings, 3:22190 (HASL—325, pp 161-164)
**Knyazev, S.A.,** *See* Baratov, D.G., 3:22110
**Kobayashi, K.,** *See* Nakamura, A., 3:21444
*See* Nishihara, H., 3:21147
**Kobayashi, M.,** *See* Senjo, T., 3:20907
**Kobayashi, R.,** *See* Hwang, S.C., 3:21256
**Kobierecki, M.,** *See* Rienecker, F., 3:22645
**Koch, T.R.,** *See* Maffly, R.L., 3:21970
**Koch, T.R Maffly, R.L.,** *See* Schultz, A.J., 3:21935
**Kochetkova, R.P.,** Gas chromatographic method for determination of content of petroleum sulfones in wastewaters, 3:21018
**Kochetov, I.V.,** *See* Sharkov, V.F., 3:22054
**Kochina, I.N.,** Hydrodynamic investigation of gas volume dynamics in a stratum of constant thickness, 3:21099
**Koeing, A.L.,** *See* Moore, R.T., 3:21219
**Koenig, V.,** *See* Gruebler, W., 3:22338
**Koenigshofer, D.R.,** Integrating solar heating and off peak electricity usage, 3:21358
**Koepke, B.,** *See* Zook, J.D., 3:21273
**Koester, J.K.,** *See* Eustis, R.H., 3:21765
**Koger, R.K.,** Regulatory constraints on solar energy and thermal-storage installations, 3:21746
**Koizlik, K.,** *See* Linke, J., 3:21574
**Kolbycheva, P.D.,** *See* Klimkin, V.M., 3:22052
**Kolinsyk, G.P.,** *See* Kochetkova, R.P., 3:21018
**Kolyer, J.M.,** Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July—September 1977, 3:21275 (ERDA/JPL/954458—77/6)
**Komarov, V.V.,** *See* Afonin, A.G., 3:22117
*See* Baratov, D.G., 3:22116
**Kondrat'eva, M.,** *See* Szomodyi, A., 3:22336
**Kong, A.K.,** Efficiency of grating solar cells, 3:21283
**Konopka, A.,** *See* Yudow, B., 3:21326
**Koopman, B.L.,** *See* Benemann, J.R., 3:21311
**Kopelevich, A.S.,** Concerning a relation in piston compressor thermodynamics, 3:21560

**Koposov, V.N.,** *See* Kostyuk, V.I., 3:21016
**Koppel, L.N.,** *See* Kornblum, H.N., 3:22425
**Koretskii, Y.P.,** *See* Andronov, G.A., 3:22047
*See* Sharkov, V.F., 3:22054
**Kornblum, H.N.,** Sub-keV, subnanosecond measurements of x-ray spectra from laser-produced plasmas, 3:22425 (UCRL—79782)
*See* Brooks, K.M., 3:22424
*See* Glaros, S.S., 3:22649
**Korp, J.,** *See* Beall, G.W., 3:21956
**Korsakova, I.S.,** Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils, 3:21049
**Koryagin, N.I.,** *See* Umarov, G.Ya., 3:21363
**Kosaka, T.,** *See* Tabuchi, A., 3:22258
**Kosayk, Yu.F.,** *See* Troyanovskii, B.M., 3:21611
**Koster, J.R.,** Study of the equatorial ionosphere. Interim scientific report No. 3, 1 January 1974—30 September 1976, 3:22307 (AD-A—042548)
**Kostomarov, D.P.,** *See* Dnestrovskii, Yu.N., 3:22418
**Kostyuk, A.G.,** *See* Deich, M.E., 3:21503
**Kostyuk, V.I.,** Concentrating waste streams from electric desalting units by means of contact evaporators, 3:21016
**Kosyak, Yu.F.,** Segmental radial bearings for high-capacity turbines, 3:21490
**Kotera, Y.,** *See* Dokiya, M., 3:21249, 3:21250
**Kotov, V.I.,** *See* Baratov, D.G., 3:22109, 3:22116
**Kotova, A.V.,** *See* Lobanova, G.A., 3:21047
**Kott, A.C.,** *See* Lane, G.A., 3:21672
**Kottenstette, J.P.,** *See* Freeman, J.E., 3:21683
**Kotter, F.R.,** ac transmission line field measurements, 3:21550 (HCP/T6010—E1)
**Kouts, H.,** Research required for international safeguards, 3:21224
**Koval', V.P.,** Effect of design characteristics of centrifugal injectors on liquid discharge coefficient, 3:22088
**Kowal, K.,** Disc-Donut-Tube wear test report, Phase I, 3:21588 (TID—27816)
**Kowalski, J.,** *See* Winkler, K., 3:22040
**Kozlova, T.A.,** *See* Gribkov, V.A., 3:22415
**Kozlowski, T.,** *See* Blanpied, G.S., 3:22354
**Kozubovskii, A.I.,** *See* Evdokimov, B.V., 3:20965
**Krabowski, R.A.,** *See* Hagenson, R.L., 3:22567
**Krachino, T.V.,** *See* Matskevich, T.L., 3:21905
**Kraft, C.H.,** Speed, acceleration, and pulse prediction calculations on test vehicles with wheel pulse generators, 3:21859 (SAND—78-0030C)
**Kramer, S.D.,** *See* Young, R.T., 3:21912
**Krascella, N.L.,** *See* Meyerand, R.G. Jr., 3:21245
**Krasnaya, L.V.,** *See* Zrelov, V.N., 3:21050
**Krasnoselov, G.K.,** *See* Sirina, T.P., 3:21844
**Krasutskii, G.A.,** *See* Kostyuk, V.I., 3:21016
**Kraushaar, J.J.,** *See* Morris, C.L., 3:22355
**Krauss, W.,** Currents, internal and inertial waves in a stratified ocean due to variable winds. Pt. 2, 3:22287
**Krc, A.E.,** *See* Davis, C.E., 3:21034
**Kreischer, K.,** *See* Cohn, D.R., 3:22600
**Kremenetskii, M.I.,** *See* Pozin, L.Z., 3:21083
**Kremenevskaya, E.A.,** *See* Rivkin, S.L., 3:21500
*See* Sorokina, B.A., 3:21041
**Krendelev, V.A.,** *See* Baratov, D.G., 3:22116
**Kress, T.S.,** Source term assessment concepts for LMFBRS: Aerosol Release and Transport (ART) Analytical Program, 3:21643 (ORNL/NUREG/TM—124)
**Kretschek, R.O.,** *See* Moore, W.T., 3:21383
**Krieger, C.I.,** *See* Wang, S.T., 3:22593
**Krier, J.,** *See* Buck, J.V., 3:21415
**Krier, J.E.,** *See* Bates, M.R., 3:21424
**Krikorian, O.H.,** Proposal to utilize fusion reactor energy sources for chemical process applications, 3:21248 (UCID—17590)
**Krivov, M.A.,** *See* Brudnyi, V.N., 3:21897
**Krohm, G.,** *See* Cavallo, J., 3:21739
**Krohm, G.C.,** *See* Reddy, G.N., 3:21522
**Krohn, B.J.,** *See* Fox, K., 3:22399
**Krohn, K.A.,** *See* Parks, N.J., 3:21997
**Krokhin, O.N.,** *See* Gribkov, V.A., 3:22415
*See* Zakharenkov, Yu.A., 3:22439
**Kronebusch, P.L.,** Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**Kronfeld, D.S.,** Placental transport of radionuclides. Terminal report, May 1, 1973—July 31, 1975, 3:22268 (COO—2363-4)
**Kropschot, R.H.,** Fossil energy research meeting, 3:20841 (CONF-7706100—)
**Krug, H.,** Characterization of malignant ovarian tumors by impulse cytophotometry, 3:22236 (LA-tr—77-94)
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr—77-86)
Impulse cytophotometric studies on tumor material, 3:22234 (LA-tr—77-88)
Impulse cytophotometric and repeated cytologic examinations of cervical secretions as compared with histologic findings, 3:22235 (LA-tr—77-87)
**Kruger, A.W.,** *See* Boody, F.P., 3:22636
**Kruger, C.H.,** *See* Eustis, R.H., 3:21765
**Kruger, G.B.,** Leak detection system design and operating considerations for the US-CRBRP, 3:21578 (CONF-760735—1)
**Krupke, W.F.,** *See* Jacobs, R.R., 3:21965
**Krupnyi, G.I.,** *See* Baratov, D.G., 3:22116
**Kruse, H.,** Significance of the non-azeotropic binary refrigerants, when used in heat pumps and refrigeration plants, 3:21781
**Krutiev, V.A.,** *See* Gorbanenko, A.D., 3:21007
**Kruzhilin, Y.I.,** *See* Borisov, B.N., 3:22049
**Krylov, V.V.,** *See* Ageev, A.I., 3:22107, 3:22108
**Kryukov, V.A.,** *See* Repin, N.N., 3:21081
**Kubala, D.M.,** *See* Johnson, D.H., 3:21673
**Kubota, Y.,** *See* Yora, M., 3:21402
**Kucheryavykh, E.I.,** *See* Amosov, V.V., 3:21013
**Kuhndel, K.,** *See* Krug, H., 3:22235
**Kuijpers, L.,** Determination of fast neutron spectra with activation techniques: its application in a fusion reactor blanket model, 3:22581
**Kuizenga, D.J.,** Performance of the short-pulse oscillators for Argus and Shiva, 3:22643 (UCRL—79535)
**Kukhanin, A.A.,** *See* Derkach, A.Y., 3:22009
**Kukushkin, A.N.,** *See* Deich, M.E., 3:21503
**Kulcinski, G.L.,** Considerations of the recycle time for radioactive titanium alloy structures, 3:22687
*See* Hunter, T.O., 3:22671
**Kuliev, R.Sh.,** *See* Papok, K.K., 3:20998
**Kulik, O.G.,** *See* Pan, V.M., 3:21913
**Kulkarni, S.,** *See* Graham, C.D., 3:21281
**Kull, L.A.,** Performance of safeguards technology-hardware, people, systems, 3:21226
**Kullberg, L.,** Nuclear magnetic resonance study of the structure in solution of lanthanide complexes with benzene-1,2-dioxydiacetate, 3:21960
**Kunayev, G.T.,** *See* Dyatlov, V.D., 3:22121
**Kung, R.T.V.,** High-intensity transmission characteristics of $CH_3$-$CHF_2$ and CHFCHF, 3:22027
**Kunze, W.,** Influence of ventilation on the optimal thermal protection and thermal comfort of dwellings, 3:21790
**Kupka, I.,** *See* Becka, J., 3:21874
**Kuppermann, A.,** *See* Frueholz, R.P., 3:22320
**Kuramoto, C.,** *See* Michiyoshi, I., 3:22609
**Kurashiki, O.,** *See* Hisamasu, T., 3:20908
**Kurilin, S.P.,** *See* Mamedov, F.A., 3:20966
**Kuriyagawa, M.,** Observation of rock using a heating microscope, 3:21456
**Kurnaev, O.V.,** *See* Afonin, A.G., 3:22117
*See* Baratov, D.G., 3:22116
**Kurnosov, V.I.,** *See* Derkach, A.Y., 3:22009
**Kurtmullaev, R.Kh.,** *See* Es'kov, A.G., 3:22601
**Kurtuzov, M.I.,** *See* Es'kov, A.G., 3:22601
**Kurumov, D.S.,** Experimental investigation of P-V-T dependence of cyclohexane and benzene at the melting line, 3:21042
**Kusakabe, M.,** Oxygen and sulfur isotope equilibria in the $BaSO_4$—$HSO_4^-$ — $H_2O$ system from 110 to 350°C and applications, 3:21457
**Kusiak, R.,** *See* Aitken, J.H., 3:22186
**Kusuda, T.,** Hourly solar radiation data for vertical and horizontal surfaces on average days in the United States and Canada, 3:21267 (NBS-BSS—96)
**Kuswa, G.W.,** Discussion of diagnostics techniques in particle beam fusion at Sandia Laboratories, 3:22421 (SAND—77-1829C)
**Kuwada, J.T.,** New industrial development of geothermal resources, 3:21440
**Kuz'menko, O.A.,** *See* Rzheznikov, Yu.V., 3:21506
**Kuz'micheva, L.B.,** *See* Svechkarev, I.V., 3:21890
**Kuzhel, A.A.,** *See* Nechai, A.M., 3:20946
**Kuzii, V.V.,** *See* Bulaevskii, L.N., 3:21909
**Kuznetsov, V.G.,** *See* Danchev, V.I., 3:21116
**Kuznetsov, V.M.,** *See* Didenko, A.N., 3:22104
**Kvasha, A.I.,** Fast accelerating field stabilization systems for the accelerator resonators of the meson factory, 3:22112 (LA-tr—77-93)
*See* Guseva, K.I., 3:22113
**Kyle, G.S.,** *See* Blanpied, G.S., 3:22354

## L

**L'vova, A.I.,** *See* Smirnova, L.A., 3:20999
**Lachinov, V.M.,** *See* Ageev, A.I., 3:22107, 3:22108
**Lagun, V.N.,** *See* Borisov, B.N., 3:22049
**Lai, K.W.,** *See* Grannan, D.M., 3:22331
**Lai, W.,** BWR Mark I pressure suppression study: bench mark experiments, 3:21649 (UCID—17661)
BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function, 3:21650 (UCID—17662)
**Laidler, J.J.,** *See* Garner, F.A., 3:22680
**Laing, E.W.,** Electrostatic potential in a low-density plasma in toroidal systems, 3:22464
**Lake, M.A.,** Mass transfer characterization of Donnan dialysis, 3:21944
**Lakhno, Y.V.,** *See* Avanesyan, V.S., 3:22055
**Lam, C.,** Acceleration of one ampere negative ion beams to energies up to 120 keV, 3:22614 (BNL—23391)

**Lamey, S.C.,** Organic composition of Devonian Shale from Perry County, Kentucky, 3:21102 (MERC/TPR—77/3)
**Lammertz, H.,** *See* Brodda, B.G., 3:21156
**Lamonov, V.M.,** *See* Sharkov, V.F., 3:22054
**LaMori, P.N.,** Outlook for utility development of geothermal resources, 3:21392
**Lampton, M.,** *See* Swank, J., 3:22296
**Landeene, B.C.,** *See* Huffman, W.J., 3:21304
**Lander, G.H.,** *See* Buyers, W.J.L., 3:21901
**Lane, G.A.,** Macro-encapsulation of heat storage phase-change materials for use in residential buildings. First quarterly progress report, September 29—December 29, 1976, 3:21672 (ORO/5217—1)
**Lang, P.M.,** *See* Blanpied, G.S., 3:22354
**Langebach, H.P.,** *See* Frank, H., 3:20987
**Langer, S.,** Relative occupational risks of plutonium and $^{233}U$ fuels, 3:22266
**Langner, G.H. Jr.,** Comparison of costs of integrating working level devices, 3:22173 (HASL—325, pp 37-38)
Comparison of errors of integrating working level devices, 3:22174 (HASL—325, pp 39-42)
**Lanning, D.D.,** Instruction related to reactor safety as offered by the MIT Nuclear Engineering Department, 3:21666
**Lapshin, V.I.,** *See* Abdulin, F.S., 3:20974
**Larsen, E.M.,** *See* Abdel-Khalik, S.I., 3:22668
**Larsen, J.T.,** *See* Kornblum, H.N., 3:22425
*See* Pan, Y.L., 3:21237
**Larsen, R.C.,** *See* Grannan, D.M., 3:22331
**Larson, G.F.,** Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T—741)
**Larson, M.B.,** *See* Baker, M.S., 3:21336
**Larwood, G.M.,** *See* Secor, E.S., 3:20917
**Lasinski, T.A.,** *See* Carnegie, R.K., 3:22351
**Lastochkin, Y.A.,** *See* Baratov, D.G., 3:22110
**Latham, D.W.,** *See* Bernath, L., 3:21570
**Lathrop, J.W.,** *See* Kilby, J.S., 3:21314
**Laukhin, Ia.N.,** *See* Es'kov, A.G., 3:22601
**Laukhin, Yu.A.,** *See* Surkov, Yu.V., 3:21082
**Lauterbach, M.J.,** *See* Grannan, D.M., 3:22331
**Laville, J.L.,** *See* Gelbke, C.K., 3:22374
**Lawrence, R.J.,** *See* Herrman, W., 3:22003
**Lawrence, V.F.,** *See* Castillo, R., 3:22657
**Lawroski, H.,** *See* Langer, S., 3:22266
**Lawson, C.G.,** Helium distribution system for the Large Coil Test Facility (LCTF), 3:22594 (CONF-771029—193)
**Lawton, J.,** *See* Jones, P.L., 3:21836
**Leach, L.P.,** LOFT emergency core-cooling system experiments: results from the L1-4 experiment, 3:21652
**Leasure, R.A.,** Clinch River Breeder Reactor Plant. Effects of thermal aging on CRBRP primary piping, 3:21582 (CRBRP-ARD—0188)
**Leatham, C.H. Jr.,** *See* Heil, T.J., 3:21810
**Lebedev, N.F.,** Shape of the bottom of a drill pipe string in a borehole, 3:20971
**Lebedev, V.N.,** *See* Baratov, D.G., 3:22116
**Lederman, L.M.,** *See* Kephart, R.D., 3:22334
**Lee, A.Y.,** Thermal design and analysis of superconductors for the toroidal field coils of TNS, 3:22597 (WFPS-TME—059)
**Lee, C.K.B.,** *See* Catton, I., 3:21642
**Lee, D.,** *See* Boody, F.P., 3:22636
**Lee, D.O.,** Flow visualization in heat-generating porous media, 3:21644 (SAND—76-0614)
**Lee, J.,** *See* Aitken, J.H., 3:22167
**Lee, J.D.,** *See* Bender, D.J., 3:22542
**Lee, J.H.,** *See* Deyoung, R.J., 3:22021
**Lee, W.C.,** *See* Schwager, I., 3:20895
**Lee, Y.Y.,** *See* Grannan, D.M., 3:22331
**Leeper, R.J.,** Scintillator-photomultiplier response to a simulated REB generated thermonuclear neutron pulse, 3:22641 (SAND—77-1592C)
**Lees, A.S.,** *See* Secor, E.S., 3:20917
**Leete, S.C.,** *See* Fix, J.J., 3:22207
**Leffler, L.,** Pressurized fluidized-bed combustion combustion test and integration unit, PFBC/CTIU project. ANL monthly progress report, October 1977, 3:20923 (ANL/CTIU/FE—005)
**Legg, R.C.,** Analysis of energy demands of air-conditioning systems, 3:21782
**Legoshina, Z.A.,** *See* Zaitsev, V.A., 3:20993
**Lehnert, B.,** Thermonuclear fusion power, 3:22553
**Leifer, R.,** High altitude balloon sampling program, 3:22157 (EML—334, pp II.68-II.84)
Project Airstream, 3:22156 (EML—334, pp II.7-II.67)
Updating stratospheric inventories to April 1977, 3:22153 (EML—334, pp I.3-I.14)
**Leigh, J.D.,** Quantitative respirator mantesting at Rocky Flats, 3:22010 (RFP—2433)
**Leipelt, G.R.,** *See* Brooks, K.M., 3:22424
*See* Slivinsky, V.W., 3:22648
**Leipold, T.,** *See* Harboe, R., 3:21264
**Leipuner, L.B.,** *See* Grannan, D.M., 3:22331
**Leisey, F.,** Heating value and specific gravity measurement of natural gas for custody transfer using a computer operated process chromatography system, 3:21091 (CONF-770375—, pp 45-49)
**Leith, D.W.G.S.,** *See* Carnegie, R.K., 3:22351
**Lenahan, J.P.,** *See* Macdonald, B., 3:22124
**Leonaitis, L.L.,** Solar heating and cooling system demonstration for the School of Mechanical Engineering at Georgia Tech, 3:21351
**Leonard, B.R. Jr.,** *See* Conn, R.W., 3:22560
**Lesage, B.,** Anomalous diffusion in bcc metals of the 5th and 6th groups (Mo, Nb, Ta, W), 3:21891
**Lesic, A.,** *See* Antic, S., 3:21004
**Leslie, J.C.,** *See* Guinn, V.P., 3:21928
**Lesnichenko, A.Ya.,** *See* Lyudomirskii, B.N., 3:21498
**Lesnov, V.A.,** *See* Rabinovich, A.V., 3:21502
**Levacher, F.K.,** *See* Benndorf, H., 3:21534
**Levchenko, A.T.,** *See* Pokhmurskii, V.I., 3:20983
**Levene, L.H.,** Performance of tube-to-tubeplate welded joints in high pressure feed heaters, 3:21514
**Leventhal, L.,** *See* Claridge, D.E., 3:22226
**Levin, A.V.,** *See* Afonin, A.G., 3:22117
**Levine, I.,** *See* Gemmell, D.S., 3:22311
**Levine, R.S.,** Integrated 100% solar heated and cooled house using multi-stage air collectors, 3:21359
**Levinson, S.Z.,** *See* Alekhina, N.I., 3:21001
**Levy, M.,** *See* Waynert, J.A., 3:21880
**Lewallen, M.A.,** *See* Heeb, C.M., 3:21204
*See* Kabele, T.J., 3:21203
**Lewellen, T.K.,** Field procedure for quantitative assessment of gamma cameras, 3:22123
**Lewis, D.W.,** Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976—August 1977, 3:20840 (FE—2479-1)
**Lewis, E.E.,** Reactor safety education at Northwestern Univeristy, 3:21664
**Libove, J.,** *See* Singer, J.R., 3:22242
**Lichtin, N.N.,** Photochemical conversion of solar energy. Annual report, January 1, 1974—December 31, 1974, 3:21316 (NSF/RANN/SE/AER—72-03597/A03/74/4)
**Liddell, P.J.,** *See* Doran, J.C., 3:21460
**Lidinsky, W.P.,** *See* Fortune, P.J., 3:22689
**Lietzke, M.H.,** *See* Eraslan, A.H., 3:22216
**Likhoded, A.K.,** *See* Kartvelishvili, V.G., 3:22346
**Lilenko, Y.V.,** *See* Brudnyi, V.N., 3:21897
**Liljestrand, R.P.,** *See* Blanpied, G.S., 3:22354
**Limarenko, L.N.,** *See* Brudnyi, V.N., 3:21897
**Limaye, S.S.,** *See* Schubert, G., 3:22303
**Lin, A.T.,** Computer simulation of current penetration in a plasma, 3:22485
**Lin, T.H.,** *See* Pang, C.S., 3:21886
**Lindfors, P.A.,** Studies of $Na_2KSb(cs)$ photocathodes. Technical report 1 July 1972—31 May 1975, 3:21871 (AD-A—042253)
**Lindl, J.D.,** Low aspect ratio double shells for high density and high gain, 3:22650 (UCRL—80104)
**Lindner, D.L.,** Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy, 3:21976 (LBL—6682)
**Lindsay, W.,** Design, installation and testing of the HUD solar home in Dacula, Georgia, 3:21347
*See* McCloud, W.T. II, 3:21348
**Linke, J.,** Fundamentals on the agglomerate model and its relation to the physical properties of pyrocarbon, 3:21574
**Lipkin, G.M.,** *See* Smirnova, L.A., 3:20999
**Lipkin, H.J.,** High energy spectroscopy, 3:22341 (FERMILAB-Conf—77/66-THY)
Theoretical review of strange and nonstrange mesons, 3:22350 (FERMILAB-Conf—77/65-THY)
**Lippincott, E.P.,** *See* Fabry, A., 3:22378
**Lipsky, S.,** Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976—August 31, 1977, 3:21992 (COO—913-68)
**Lisitsyna, L.I.,** *See* Muller, Y.N., 3:22045
**Liss, H.R.,** *See* Manty, B.A., 3:21872
**Littman, F.E.,** Regional air pollution study. point source emission inventory. Final report, 3:22146 (PB—269567)
**Liu, W.S.,** *See* Glass, I.I., 3:22523
**Livingston, A.E.,** *See* Berry, H.G., 3:22130
**Livingston, R.,** *See* Zeldes, H., 3:21990
**Livshits, M.A.,** *See* Shmukler, B.I., 3:21493
**Lobanov, A.N.,** *See* Basov, N.G., 3:22044
**Lobanova, G.A.,** Distribution of sulfur compounds in Emba and Mangyshlak crude oils, 3:21047
**Lofting, E.M.,** Multisector analysis of the impact of geothermal development on the economy of Imperial County, California, 3:21430
**Lokshin, V.A.,** Improvement of the reliability of waterwall superheater of the tpp-110 steam generators, 3:21508
**London, R.E.,** Calculation of $^{13}C$ relaxation times and nuclear Overhauser enhancements in a hydrocarbon chain undergoing gauche-trans isomerism, 3:21979
**Long, C.J.,** *See* Schwall, R.E., 3:22591
**Long, R.L.,** Implementation of availability engineering in the nuclear utility industry, 3:21555
**Lonngren, K.E.,** Consequence of the invariance of Biot's variational principle in thermal conduction, 3:22400
**Lopatin, N.V.,** Oil formation in the process of lithogenesis in the light of the systems approach, 3:20940
**Loree, T.R.,** Spectral tuning of ArF and KrF discharge lasers, 3:22031

**Lorenzen, H.,** *See* Relotius, P.C., 3:21056
**Losey, R.E.,** *See* Reily, J.C., 3:21270
**Louis, J.F.,** Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976—February 28, 1977, 3:21754 (FE—2215-7)
**Lousteau, D.C.,** *See* Corwin, W.R., 3:22682
**Loveland, W.,** *See* Chick, S.W.K., 3:22217
**Lovell, E.G.,** *See* Abdel-Khalik, S.I., 3:22668
**Lovell, H.L.,** *See* Spackman, W., 3:20889
**Low, W.,** *See* Franck, J.V., 3:22602
**Lowder, W.M.,** Application of field spectrometry to radiation studies in phosphate regions, 3:22188 (HASL—325, pp 155-160)
**Lu, K.M.,** *See* Zaborszky, J., 3:21470
**Lugan, V.P.,** *See* Simoyu, L.L., 3:22087
**Lur'e, S.I.,** *See* Ageev, A.I., 3:22107
**Lur'ev, M.V.,** Calculation of the time of flow of a film of a viscous petroleum product from the inner surface of railroad tank-cars, 3:21038
**Luther-Davies, B.,** Evidence of resonance absorption in laser-produced plasmas from the polarization and angular dependence of high-energy x-ray bremsstrahlung emission, 3:22472
**Luthey, J.L.,** *See* Parker, R.H., 3:22306
**Luthy, D.F.,** Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April—June 1977, 3:21172 (MLM—2463)
**Lutz, G.J.,** Determination of bismuth by photon activation analysis, 3:21927
**Luzzati, V.,** *See* Tardieu, A., 3:22232
**Lyon, J.F.,** *See* Bush, C.E., 3:22579
**Lytle, J.M.,** Residence time measurements in a coal hydrogenation process, 3:20848
**Lyubchik, G.N.,** *See* Borblik, E.L., 3:21763
**Lyudomirskii, B.N.,** Thermally stressed state of rotors in end seal zones of the T-100-130 turbine in steamless operating conditions, 3:21498

## M

**MacDiarmid, A.G.,** *See* Graham, C.D., 3:21281
*See* Hastings, J.M., 3:21914
**Macdonald, B.,** Noise in 3-D imaging with large-area positron cameras, 3:22124
**Macdonald, R.G.,** Reaction and deactivation of HCl (v=1, 2) by O atoms, 3:21949
**Macfarland, W.J.,** *See* Brown, D.H., 3:21479
**Machiels, A.J.,** Molecular beam study of the kinetics of the fluorine—uranium dioxide reaction, 3:21998
**Maciolek, R.B.,** *See* Zook, J.D., 3:21273
**Mack, J.D.,** *See* Johnson, G.E., 3:20904
**Macklin, R.L.,** *See* Musgrove, A.R.L., 3:22366
**MacLean, L.,** *See* Nyein, R.K., 3:20978
**MacLean, S.C.,** DT fusion neutron irradiation of LLL stainless steel tensile specimens at 450°C, 3:21894 (UCID—17665)
DT fusion neutron irradiation of LLL Nb—1Zr tensile specimens at 600°C, 3:21895 (UCID—17666)
DT fusion neutron irradiation of LLL niobium, 3:22390 (UCID—17669)
**MacRae, E.C.,** Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB—268850)
**Maddox, R.N.,** Sweetening of light hydrocarbon liquids, 3:21073 (CONF-7603113—, pp H1-H23)
**Madelaine, G.,** *See* Duport, P., 3:22267
**Madia, W.J.,** *See* Schwendiman, L.S., 3:22013
**Madland, D.,** *See* Blanpied, G.S., 3:22354
**Maeda, K.,** *See* Mochida, I., 3:20985
**Maeda, M.,** *See* Pigford, T.H., 3:21233
**Maffly, R.L.,** Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate, 3:21970
**Magasanik, D.,** Recent development of the process and mineral industries in Australia, 3:21111
**Magelssen, G.R.,** *See* Moses, G.A., 3:22670
*See* Moses, G.A. Conn, R.W., 3:22669
**Maggiora, G.M.,** *See* Christoffersen, R.E., 3:21975
**Maglich, B.C.,** 1976 status of the migma program of controlled fusion, 3:22548
Unified criterion for proximity to controlled fusion, 3:22582
*See* Menasian, S.C., 3:22437
**Magnuson, D.W.,** *See* Clayton, E.D., 3:21215
**Mahan, B.H.,** Some features of the potential energy surfaces for the $F^+ + H_3$ ion—molecule reaction, 3:22321
**Mahoney, J.,** *See* Gelbke, C.K., 3:22374
**Mainone, D.,** *See* Pfeifer, H.J., 3:22022
**Maisheev, V.A.,** *See* Baratov, D.G., 3:22109
**Majumdar, D.,** Generic PSAR for the TF coil system of tokamak fusion reactors, 3:22632
**Majumdar, S.,** Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**Makarov, E.F.,** *See* Alexandrov, A.J., 3:21239
**Makarov, L.V.,** *See* Evdokimov, B.V., 3:20965
**Maki, A.G.,** Further assignments for the far-infrared laser transitions of HCN and $HC^{15}N$, 3:22033
**Makovsky, L.E.,** *See* Brown, F.R., 3:20846
**Maksudov, T.M.,** *See* Vakhidov, A.T., 3:21366
**Mal'tsev, B.K.,** *See* Gordon, B.G., 3:21660
**Malakhova, T.A.,** *See* Entov, V.M., 3:22285
**Malamud, E.,** *See* Akimov, Y., 3:22333
**Malaviya, B.K.,** Integration of nuclear reactor safety in instructional programs at RPI, 3:21663
**Maley, M.P.,** LASL $Nb_3Ge$ conductor development. Eighth quarterly progress report, July 1—September 30, 1977, 3:21553 (LA—7037-PR)
**Malik, M.A.,** *See* Debs, A.S., 3:21344
**Maliutin, A.I.,** *See* Es'kov, A.G., 3:22601
**Malkhov, L.N.,** *See* Avanesyan, V.S., 3:22055
**Mallett, R.H.,** Clinch River Breeder Reactor Plant. Integrity of primary and intermediate heat transport system piping in containment, 3:21635 (CRBRP-ARD—0185(Vol.1))
**Malone, R.C.,** Resonant absorption in plasma density profiles produced by laser heating, heat flow, and hydrodynamics, 3:22459
**Malyavinskii, L.V.,** Effectiveness of smoke suppression additives for diesel fuels, 3:21000
**Malygin, E.P.,** *See* Basov, N.G., 3:22051
**Malyshev, V.K.,** *See* Basov, N.G., 3:22051
**Mamedov, F.A.,** Obtaining a circular rotating field in a capacitor electrodrill operating at different depths, 3:20966
**Mamedova, M.A.,** *See* Gurbanov, R.S., 3:20975
**Mamedova, P.M.,** *See* Kerimov, Z.G., 3:20970
**Man'kin, M.N.,** *See* Rabinovich, A.V., 3:21502
**Managoli, V.,** Successive and simultaneous transfer descriptions of (p,t) reactions on $^{208}Pb$, 3:22371
**Mancini, T.R.,** *See* Moore, R., 3:21340
**Manes, K.,** *See* Rienecker, F., 3:22645
**Manes, K.R.,** Shiva target irradiation facility, 3:22647 (UCRL—79784)
**Mange, J.,** Where is Argentina going in geothermal energy, 3:21395 (NP—22124)
**Manghnani, M.H.,** *See* Ming, L., 3:21879
**Mangione, B.,** Industrial electric power rates in the mid-1980s, 3:21744
**Manheimer, W.M.,** *See* Max, C.E., 3:22458
**Manicyev, O.D.,** Dynamic characteristics of the P-49 steam generator for a 500 MW power block, 3:21489
**Maniscalco, J.A.,** Conceptual design of a laser fusion power plant, 3:22665
*See* Hansen, L.F., 3:22539
*See* Meier, W.R., 3:22608
**Mann, N.R.,** *See* Kolyer, J.M., 3:21275
**Manty, B.A.,** Wear resistant coatings for titanium alloys. Final report 15 March 1976—15 March 1977, 3:21872 (AD-A—042443)
**Maples, C.,** Nuclear data sheets for A=215, 3:22372
Nuclear data sheets for A=219, 3:22373
Nuclear data sheets for A=223, 3:22376
Nuclear data sheets for A=227, 3:22377
**Marbach, G.,** Anomalous self-diffusion in rare earths and actinides, 3:21892
**Marchant, D.D.,** *See* Boquist, C.W., 3:21762
**Marchenko, Yu.A.,** Investigation of the efficiency of the low pressure cylinder of the K-200-130 turbine manufactured by the Leningrad Metal Works prior to and after modernization, 3:21497
**Marchetti, C.,** On strategies and fate, 3:21721
**Marchini, R.,** Selective absorption properties of lead sulfide—aluminum coatings as a function of lead sulfide thickness, 3:21371
**Marcus, F.B.,** *See* Peng, Y-K.M., 3:22561
**Marennikov, S.I.,** *See* Gusev, Yu.L., 3:22039
**Margulova, T.Kh.,** Some problems of optimization of thermal diagrams of single-loop nuclear power plants, 3:21561
**Mariani, E.,** *See* Capasso, A., 3:21511
**Marinchenko, N.I.,** *See* Zrelov, V.N., 3:21050
**Markelov, S.V.,** *See* Zhilinskii, A.P., 3:22503
**Markin, A.E.,** *See* Es'kov, A.G., 3:22601
**Markov, P.,** *See* Akimov, Y., 3:22333
**Markozov, N.D.,** *See* Simoyu, L.L., 3:22087
**Marmorshtein, L.M.,** *See* Entov, V.M., 3:22285
**Maroni, V.A.,** *See* Misra, B., 3:22610
**Marshall, B.L.,** *See* Coleman, J.J., 3:22064
**Marshall, P.,** Ford foundation report 'too optimistic' on US uranium supplies, 3:21112
**Marshall, W.F.,** $NO_2$ levels in diesel exhaust, 3:22090 (BERC/TPR—78/1)
**Martell, E.A.,** Cancer induction by alpha emitting warm particles, 3:22254
**Martin, A.A.,** *See* Hlavin, A.C., 3:21353
**Martin, C.L.,** Lattice physics methods. Licensing topical report, 3:21557 (NEDO—20913A)
**Martin, C.W.,** *See* Asperger, R.G., 3:21068
**Martin, J.G.,** Experiment in undergraduate education: the fusion design team, 3:22574
*See* Hanley, D.W., 3:22257
**Martin, W.E.,** *See* Johnson, B.C., 3:22036
*See* Kuizenga, D.J., 3:22643
**Martinez, J.D.,** Evaluation of hydrologic isolation from evidence in mine openings in igneous and metamorphic rocks in the Maritime Provinces of Canada, 3:21181 (ORNL/Sub—4415)
**Martonchik, J.,** *See* Knollenberg, R.G., 3:22305

**Marx, W.B.,** Industry capability to supply equipment, 3:21812 (CONF-770658—, pp 223-248)
**Mase, A.,** *See* Iguchi, H., 3:22407
**Maselter, H.,** *See* Brodda, B.G., 3:21156
**Mason, D.M.,** Petrographic method for selective determination of a component (raw coal) in a mixture of products from processing of coal, 3:20850 (CONF-780305—1)
**Masters, L.W.,** *See* Skoda, L.F., 3:21331
**Mastryukov, A.F.,** *See* Zakharov, V.E., 3:22533
**Mateu, L.,** *See* Tardieu, A., 3:22232
**Mathern, G.,** *See* Seraphin, L., 3:21568
**Mathew, A.,** *See* Schmitz, H., 3:21796
**Mathey, R.G.,** *See* Rossiter, W.J. Jr, 3:21773
**Mathias, G.,** Simulation of the active power dynamics of parallel-circuit electrical energy supply networks, 3:21535
**Mathieu, G.,** *See* Biscaye, P.E., 3:22215
**Matskevich, T.L.,** Thermionic emission of zirconium carbide in hydrogen, 3:21905
**Matsuda, M.,** *See* Tabuchi, A., 3:22258
**Matsumoto, H.,** *See* Yamaguchi, K., 3:21286
**Matsunaga, I.,** *See* Kuriyagawa, M., 3:21456
**Matsunaga, T.,** *See* Isao, K., 3:21251
**Matsuura, S.,** Plan for steam transport facilities at Kuzuneda geothermal power plant, 3:21446
**Matteson, J.L.,** Background effects in scintillation counter telescopes in the upper atmosphere, 3:22125
**Matthaey, H.,** *See* Appel, H., 3:22111
**Matthews, R.D.,** Nature and formation of nitrogenous air pollutant emissions from combustion systems, 3:21999 (LBL—6850)
**Matveev, E.V.,** *See* Ageev, A.I., 3:22107
**Matyushko, B.N.,** *See* Mazagarov, A.M., 3:21086
*See* Sergeev, A.D., 3:20992
**Matzke, Hj.,** *See* Benedict, U., 3:21150
**Maung, T.,** *See* Reynolds, G.M., 3:21922
**Maurice, Y.T.,** Geochemical methods applied to uranium exploration in southwest Baffin Island, 3:21131
**Max, C.E.,** Enhanced transport across laser generated magnetic fields, 3:22458
**Maxson, S.J.,** *See* Huempfner, R.A., 3:22209
**May, J.R.,** *See* Lawson, C.G., 3:22594
**May, R.T.,** Preliminary study of favorability for uranium of the Sangre de Cristo Formation in the Las Vegas basin, northeastern New Mexico, 3:21123 (GJBX—82(77))
**Maynard, C.W.,** *See* Abdel-Khalik, S.I., 3:22668
**Mazagarov, A.M.,** Desulfurization of wide cut of light hydrocarbons from Orenburg gas condensate, 3:21086
**Mazarakis, M.G.,** *See* Menasian, S.C., 3:22437
**Mazurov, V.I.,** *See* Bortnikov, A.V., 3:22555
**McAlees, D.G.,** *See* Uckan, N.A., 3:22537
**McCabe, J.T.,** Evaluation of pump used for in situ oil recovery from tar sands, 3:21103 (MTI—78TR16)
**McCallister, R.A.,** *See* Kane, R.S., 3:20863
**McCarley, R.E.,** *See* Templeton, J.L., 3:21952
**McCarthy, R.L.,** *See* Kephart, R.D., 3:22334
**McCaslin, B.,** *See* Sivinski, H.D., 3:21240
**McCauley, E.W.,** *See* Lai, W., 3:21649, 3:21650
**McCauley, R.A.,** Fuel conservation means for internal combustion engines and the like, 3:21863
**McCloud, W.T. II,** Design and installation of hydronic solar systems for three cycle-two HUD housing units in Georgia, 3:21348
**McConnell, L.D.,** *See* Baker, G., 3:21777
**McCoy, H.E. Jr.,** Status of materials development for molten salt reactors, 3:21587 (ORNL/TM—5920)
**McCoy, R.,** *See* Leisey, F., 3:21091
**McCracken, R.J.,** Energy policy and research: discussion from the USDA perspective, 3:21698
**McCray, R.,** *See* Weaver, R., 3:22301
**McDaniels, D.K.,** *See* Blanpied, G.S., 3:22354
**McDermott, M.,** Field surveys using a portable gamma ray scintillometer, 3:21128
**McDonnell, W.R.,** Fission-fragment-induced helium blistering of $^{252}$Cf-exposed surfaces, 3:22679 (DP-MS—77-47)
**McDowell, W.J.,** *See* Bouwer, E.J., 3:21941
**McElroy, W.N.,** *See* Fabry, A., 3:22378
**McFarland, J.W.,** *See* Burt, O.R., 3:21694
**McGee, J.P.,** *See* McCabe, J.T., 3:21103
**McGlynn, S.P.,** Physico-chemical study of some areas of fundamental significance to biophysics. Final report, 1974—1977, 3:21978 (ORO—3018-180)
**McGowan, F.K.,** Coulomb excitation of $^{182,184,186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**McKay, H.A.C.,** Solvent extraction in the nuclear industry, 3:21155
**McKee, R.L.,** Evolution in design, 3:21066 (CONF-770375—, pp 123-125)
**McKinnon, M.A.,** *See* Conn, R.W., 3:22560
**McKlveen, J.W.,** *See* Bouwer, E.J., 3:21941
**McMahon, D.G.,** *See* Meyerand, R.G. Jr., 3:21245
**McMillan, B.G.,** *See* Akers, D.J., 3:20892
**McMillan, W.W.,** Stream preservation training, 3:21031
**McMurtrie, W.D.,** *See* Heath, L.J., 3:20949
**McNally, J.R. Jr.,** Fusion-fission analogy, 3:22404 (CONF-771109—85)
*See* Peng, Y-K.M., 3:22561
**McNamee, P.C.,** *See* Gunion, J.F., 3:22352
**McNeany, S.R.,** Criticality considerations for $^{233}$U fuels in an HTGR fuel refabrication facility, 3:21144 (ORNL/TM—6136)
**Mead, W.C.,** Recent advances in near-term laser-fusion target design, 3:22644 (UCRL—79736)
**Mearns, A.J.,** *See* Sherwood, M.J., 3:22219
**Medeiros, G.C.,** *See* Farrington, J.W., 3:21053
**Medina, L.C.,** Radiation monitor training program at Rocky Flats, 3:22281 (RFP—2434)
**Mei, H.,** Analysis of a solar powered residential cooling and heating system, 3:21355
**Meier, H.,** Radioactive halos as possible indicators for geochemical processes in magmatites, 3:21135
**Meier, P.,** *See* Kiessling, F., 3:21551
**Meier, W.R.,** Liquid metal requirements for inertial confinement fusion, 3:22608 (UCRL—80424)
*See* Maniscalco, J.A., 3:22665
**Mel'nikov, M.V.,** *See* Grigor'ev, E.I., 3:21301
**Meldner, H.W.,** *See* Blink, J.A., 3:22675
**Melik-Akhnazarov, T.Kh.,** *See* Alekhina, N.I., 3:21001
**Melsheimer, S.S.,** *See* Lake, M.A., 3:21944
**Melton, D.E.,** *See* Reily, J.C., 3:21270
**Menasian, S.C.,** Advanced fuel fusion experimentation with migmacells II and III orbit diagnostics and lifetime measurements, 3:22437
**Menke, K.,** *See* Ageev, A.I., 3:22107
**Menlove, H.O.,** Nondestructive analysis methods for the measurement of special nuclear materials, 3:21229
*See* Ensslin, N., 3:21230
**Mense, A.T.,** *See* Peng, Y-K.M., 3:22561
**Merker, E.A.,** *See* Afonin, A.G., 3:22117
**Merkurova, M.S.,** *See* Deberdeev, I.Kh., 3:20921
**Mermaz, M.C.,** *See* Gelbke, C.K., 3:22374
**Merritt, B.,** *See* Rienecker, F., 3:22645
**Metzger, A.E.,** *See* Parker, R.H., 3:22306
**Meyer, D.I.,** Search for neutral heavy leptons, 3:22327
**Meyer, I.,** Shock waves and ionizing radiation in plasmas produced by a mode-locked laser, 3:22474
**Meyer, R.A.,** Evidence for the coexistence of shapes in even-mass Cd nuclei, 3:22357
*See* Glascock, M.D., 3:22363
**Meyer-Kahrweg, H.,** Development of the combined gas-steam turbine power plants, 3:21483
**Meyerand, R.G. Jr.,** Photo-electrolytic production of hydrogen, 3:21245
**Meyers, A.C. III,** Preliminary performance data on a solar heated house (Model 24-31-B SH), 3:21341
**Michaelis, M.M.,** *See* Rumsby, P.T., 3:22512
**Michalowski, M.,** *See* Piotrowska, E., 3:21838
**Michel, C.,** *See* Baarli, J., 3:22262
*See* Blattman, H., 3:22263
**Michel, J.,** Single crystal silicon photocells for terrestrial use: state of the art and future prospects, 3:21294
**Michiyoshi, I.,** Local properties of vertical mercury-argon two-phase flow in a circular tube under transverse magnetic field, 3:22609
**Mikaelian, K.O.,** Weak neutral currents and photoproduction of lepton pairs, 3:22343
**Mikahylovskii, A.B.,** *See* Sardakov, V.M., 3:22416
**Mikhailov, I.A.,** *See* Alekhina, N.I., 3:21001
**Mikhailov, S.Ya.,** *See* Shmukler, B.I., 3:21493
**Mikhailov, V.I.,** High-current, high pulse rate electron accelerator with inductive energy storage, 3:22101
**Mikhailov, V.M.,** *See* Lur'ev, M.V., 3:21038
**Milde, W.,** *See* Wirth, G., 3:21138
**Miley, G.H.,** Studies of deuterium-fueled Tokamak reactors, 3:22624
*See* Boody, F.P., 3:22636
*See* Hively, L.M., 3:22589
*See* Prelas, M.A., 3:22673
*See* Stimpson, H.R., 3:22470
*See* Wang, M.Y., 3:22417
**Millegan, D.R.,** *See* Dowdy, E.J., 3:21234
**Miller, A.B.,** *See* O'Connell, L.G., 3:21857
**Miller, C.W.,** *See* Hoffman, F.O., 3:22208
**Miller, G.E.,** *See* Volborth, A., 3:20888
**Miller, J.S.,** *See* Heath, L.J., 3:20949
**Miller, K.J.,** Desulfurization of various midwestern coals by flotation, 3:20918 (BM-RI—8262)
**Miller, L.R.,** *See* Wong, A.Y., 3:22565
**Miller, R.A.,** Generalized criterion for controlled fusion, 3:22583
**Miller, W.F. Jr.,** *See* Wienke, B.R., 3:22469
**Miller, W.J.,** Silicon halide—alkali metal flames as a source of solar grade silicon. First quarterly report, 3:21278 (ERDA/JPL/954777—77/1)
**Milligan, W.O.,** *See* Beall, G.W., 3:21956
**Milne, T.A.,** Direct sampling and characterization of gaseous species responsible for fireside corrosion in fossil fuel-fired systems. Fourth quarterly progress report, January 1—March 31, 1977, 3:20928 (FE—2288-16)
**Milner, W.T.,** *See* McGowan, F.K., 3:22370
**Milovsoroff, P.,** *See* Schwab, J., 3:20899, 3:20900
**Mima, K.,** Nonlinear instability of electromagnetic drift waves, 3:22482

*See* Hasegawa, A., 3:22508
**Minasyan, R.G.,** Water supply for thermal and atomic electrical power stations and water conservation, 3:21481 (ORNL-tr—4519)
**Mindek, G.,** *See* Baarli, J., 3:22253
*See* Heinzel, F., 3:22261
**Ming, L.,** Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**Mink, R.,** *See* Schultz, A.J., 3:21951
**Mirgorodskii, I.S.,** *See* Godik, I.B., 3:21488
**Miro, N.D.,** *See* Hastings, J.M., 3:21914
**Miroshnichenko, A.M.,** Pilot commercial carbonization of 50% gas—coal blends, 3:20844
**Mis'ko, O.M.,** *See* Zaitsev, V.A., 3:20993
**Misakian, M.,** *See* Kotter, F.R., 3:21550
**Mischke, R.E.,** *See* Perry, D.G., 3:22118
**Mishchenko, L.,** *See* Szomodyi, A., 3:22336
**Mishima, J.,** *See* Schwendiman, L.S., 3:22013
**Mishin, K.Y.,** *See* Alexandrov, A.J., 3:21239
**Misra, A.K.,** Time-dependent strain in rocks and its significance in mining, 3:22091
**Misra, B.,** Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
*See* Majumdar, S., 3:22611
**Mitchell, T.P.,** *See* Cupp, G.M., 3:21120
**Mitchener, J.L.,** Economic model of a relativistic electron beam hybrid reactor, 3:22662
**Mitchner, M.,** *See* Eustis, R.H., 3:21765
**Mittelstaedt, E.,** Currents along the Northwest African coast South of 22° North, 3:22288
**Miura, I.,** *See* Prestwich, G.D., 3:21980
**Miyamatsu, T.,** *See* Kakihana, H., 3:21142
**Miyazawa, M.,** *See* Tanaka, S., 3:21442
**Mizawa, S.,** *See* Kuriyagawa, M., 3:21456
**Mizusawa, S.,** After-burning preventive and flame-out apparatus, 3:21865
**Mizutani, Y.,** *See* Katsuki, M., 3:21866, 3:21867
**Mladejovsky, M.G.,** *See* Lytle, J.M., 3:20848
**Mladenovic, M.,** *See* Antic, S., 3:21004
**Moalem, D.,** Nucleate boiling at a liquid—liquid interface, 3:22071
**Mobley, R.M.,** *See* Bradley, R.F., 3:21165
**Mochida, I.,** Desulfurization of petroleum residues and their carbonization properties, 3:20985
**Mochizuki, T.,** Photoionization of uranium atoms by an argon ion laser, 3:22315
**Moebius, E.,** *See* Himmel, G., 3:22452
**Moeller, D.W.,** Environmental surveillance for nuclear facilities, 3:21202
**Moir, R.W.,** Neutral beam based on positive ions with direct energy conversion, 3:22623 (UCRL—80418)
Neutral beam requirements for mirror reactors, 3:22622 (UCRL—80408)
Tandem mirror reactor, 3:22541 (UCRL—80075)
**Moiseev, S.S.,** *See* Karas', V.I., 3:22394
**Moizhes, L.L.,** *See* Afonin, A.G., 3:22117
*See* Baratov, D.G., 3:22116
**Molchanov, A.G.,** *See* Voitik, M.G., 3:22042
**Molochev, V.I.,** *See* Basov, N.G., 3:22051
**Molvik, A.W.,** *See* Damm, C.C., 3:22543
**Monahan, J.F.,** *See* Kinderman, A.J., 3:22695
**Monastyrskaya, A.R.,** *See* Mostinskii, I.L., 3:21761
**Mondshine, T.C.,** Laundering of oil base mud cuttings, 3:21006
**Monemar, B.A.,** Optical studies of defects and degradation in GaAs—GaAlAs double-heterostructure laser materials, 3:22058
**Monsler, M.J.,** Fluorescence-pumped selenium photolytic gas laser system for a commercial laser fusion power plant, 3:22664
*See* Maniscalco, J.A., 3:22665
**Montgomery, D.B.,** *See* Cohn, D.R., 3:22600
**Montgomery, W.D.,** Structure of the geothermal industry through 1974, 3:21426
*See* Bates, M.R., 3:21424
**Moore, C.B.,** *See* Macdonald, R.G., 3:21949
**Moore, C.F.,** *See* Morris, C.L., 3:22355
**Moore, F.M.,** Iron sponge treating of natural gas liquids, 3:21074 (CONF-7603113—, pp I1-I9)
**Moore, N.D.,** *See* Holliden, G.A., 3:21525
**Moore, R.,** Unique solar residence uses conventional construction techniques, 3:21340
*See* Weaver, R., 3:22301
**Moore, R.T.,** Computerized site security monitor and response system, 3:21219 (PB—269346)
**Moore, W.T.,** Concentrating heliostat array for industrial applications, 3:21383
**Morabito, J.J.,** Introduction to materials consideration for LMFBR components, 3:21593
**Morelli, V.,** *See* Dellariprete, C., 3:21622
**Morikawa, M.,** *See* Mochizuki, T., 3:22315
**Morikawa, Y.,** *See* Tagawa, T., 3:21445
**Morozova, V.I.,** *See* Miroshnichenko, A.M., 3:20844
**Morris, C.L.,** Definitive test of outgoing-nucleon analog charge exchange using the reactions $^{12}C(\pi^{+-}\ ^{12}C(4.44$ and 15.11 MeV), 3:22355
*See* Blanpied, G.S., 3:22354
**Morris, M.E.,** *See* Sivinski, H.D., 3:21240
**Morrison, R.L.,** Continuous water monitor for oil-shale retort effluent, 3:21108 (UCID—17682)
**Morse, A.S.,** *See* Kiselewich, S.J., 3:21806
**Morse, R.L.,** *See* Malone, R.C., 3:22459
**Morse, W.M.,** *See* Grannan, D.M., 3:22331
**Mortensen, J.J.,** Proceedings of the second NATO-CCMS information meeting on dry hot rock geothermal energy, 3:21448 (LA—7021-C)
**Moses, G.A.,** PHD-IV, a laser-plasma simulation code, 3:22670
*See* Abdel-Khalik, S.I., 3:22668
*See* Conn, R.W., 3:22667
**Moses, G.A. Conn, R.W.,** Laser, optics, and pellet design for SOLASE, 3:22669
**Moskalenko, V.A.,** Tunnel contacts in superconductors with a paramagnetic impurity, 3:22395
**Moss, J.,** Fusion moves from plasma physics research to reactor engineering, 3:22545
**Mossteller, T.L.,** Preparation of an oil spill prevention training program, 3:21029
**Mostinskii, I.L.,** Efficiency of various systems for lead-in and lead-out of an ionizing additive for a power station with an open-cycle MHD generator, 3:21761
**Mostrom, M.A.,** Raman sidescatter instability in a nonuniform plasma, 3:22506 (LBL—6703)
**Motes, B.J.,** *See* Dyer, N.C., 3:21623
**Motz, H.,** *See* Rumsby, P.T., 3:22512
**Moulthrop, P.H.,** Analysis of a proposed tidal power plant in the Gulf of Mexico, 3:21458 (UCID—17677)
**Mount, R.E.,** *See* Berkowitz, M., 3:21854
**Mueller, W.H.,** Experimental investigations on anhydrite. Report No. 2, 3:21195 (DOE-tr—49)
**Mueller-Duysing, W.,** *See* Heinzel, F., 3:22261
**Muetterties, E.L.,** Coordination chemistry guide to structural studies of chemisorbed molecules, 3:21953
**Mukherjee, S.,** *See* Gupta, M.R., 3:22516
**Mukhin, A.I.,** *See* Baratov, D.G., 3:22116
**Mukhin, S.,** *See* Akimov, Y., 3:22333
**Muller, Y.N.,** Microwave-pumped helium—neon laser, 3:22045
**Mulready, J.,** Caroline carbon dioxide field and associated carbon dioxide occurrences, gambier embayment, south australia, 3:21063
**Murakami, M.,** *See* Young, R.T., 3:21912
**Murano, R.,** *See* Lewellen, T.K., 3:22123
**Murarka, I.P.,** Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs, 3:22210 (ANL/ES—61)
**Murat, M.,** Low compression ratio highly supercharged two-stroke engine, 3:21853
**Murata, M.,** *See* Arai, Y., 3:20989
**Muratov, Y.V.,** *See* Ageev, A.I., 3:22107, 3:22108
**Murdaev, R.M.,** *See* Kurumov, D.S., 3:21042
**Murdock, B.A.,** Postirradiation examination results for the Irradiation Effects Test Series IE-ST-2, Rod IE-002, 3:21563 (TREE-NUREG—1177)
**Murgatroyd, R.A.,** *See* Kelly, B.T., 3:21884
**Murin, B.P.,** *See* Guseva, K.I., 3:22113
*See* Kvasha, A.I., 3:22112
**Murphy, A.,** Coal pump development and technical support. Quarterly project report. Report No. 2, 3:20852 (DOE/JPL/2616—2)
**Murray, L.E.,** *See* Guinn, V.P., 3:21928
**Musgrave, B.C.,** *See* Slansky, C.M., 3:21169
**Musgrove, A.R.L.,** High resolution neutron transmission and capture for $^{91}Zr$, 3:22366
Neutron resonance parameters of $^{90}Zr$ below 300 keV, 3:22365
**Musial, E.M.,** *See* Tulecki, J., 3:22259
**Myasoedov, N.F.,** Chemical aspects of controlled thermonuclear synthesis problem. Review, 3:22629
**Myers, B.F.,** Behavior of fission product gases in HTGR fuel material, 3:21572 (GA-A—13723)
**Myers, D.,** *See* Berkowitz, M., 3:21854
**Myers, L.C.,** Hydrogen gas from cured RTV silicones, 3:21977 (MHSMP—77-60)
**Myznikov, K.P.,** *See* Afonin, A.G., 3:22117
*See* Baratov, D.G., 3:22116

## N

**Naaijer, G.,** Problems relative to the adaptation of photocells to terrestrial applications, 3:21296
**Nadzhafov, E.M.,** Question of restoration of injectivity of injection wells and problem of control of the gushing process, 3:20976
**Nagatani, H.,** Geological remote sensing-evaluation of image data, 3:21408
**Nair, B.R.,** *See* Mallett, R.H., 3:21635
**Nakagawa, M.,** *See* Nishihara, H., 3:21147
**Nakajima, F.,** *See* Hishinuma, Y., 3:20906
**Nakamura, A.,** Studies of cement for geothermal power generation, 3:21444
**Nakamura, N.,** *See* Mizusawa, S., 3:21865
**Nakanishi, K.,** *See* Prestwich, G.D., 3:21980
**Nakano, M.,** Proposal of a method for estimating multiple-rod worth by single-rod experiments, 3:21618
**Nakayama, N.,** *See* Yamaguchi, K., 3:21286
**Nakhman, Yu.V.,** *See* Simoyu, L.L., 3:22087
**Nanis, L.,** *See* Kapur, V.K., 3:21276
**Nann, H.,** *See* Blanpied, G.S., 3:22354
**Narayan, J.,** *See* Young, R.T., 3:21912
**Narayana, P.A.,** Electron spin echo modulation studies of silver atom solvation and desolvation in ice matrices, 3:21993
**Narzullaev, K.N.,** *See* Basov, N.G., 3:22051

**Nasibov, N.A.,** Phenomenon of jamming in single rolling cutter bit bearings, 3:20977
**Nathans, R.,** *See* Carroll, T.O., 3:21679
**Nau, J.M.,** *See* Zorowski, C.F., 3:21613
**Naurol'nyy, I.K.,** Results and effectiveness of gas prospecting operations in the main areas of the western Precaucasus, 3:21062
**Nazarenko, M.M.,** Investigation of Zeeman beats in a two-mode traveling-wave laser, 3:22043
**Nazlev, Ya.M.,** *See* Guseinov, S.O., 3:21045
**Neachu, D.,** *See* Szomodyi, A., 3:22336
**Neall, G.M.,** *See* Haycocks, C., 3:20916
**Nechal, A.M.,** Methods for interpretation of geophysical exploration data from heterogeneous carbonate reservoirs with compound porous space (on the example of Lower Cretaceous and Upper Jurassic deposits in ChI ASSR), 3:20946
**Nectoux, G.,** *See* Roux, F., 3:21567
**Needham, D.,** Distribution research, 3:21093
**Neef, W.S.,** *See* Bender, D.J., 3:22542
*See* Culver, D.W., 3:22575
**Neff, J.O.,** Perspectives on fusion power commercialization, 3:22556
**Neff, W.S. Jr.,** Remote servicing features of two new mirror fusion reactors, 3:22686
**Negamine, K.,** *See* Yamazaki, T., 3:22318
**Nekhamin, M.M.,** *See* Borblik, E.L., 3:21763
**Nelson, D.B.,** Macroscopic stability and $\beta$ limits in the ELMO Bumpy Torus, 3:22476 (ORNL/TM—5967)
**Nelson, N.S.,** Atmospheric characteristics essential for health effects modeling, 3:22181 (HASL—325, pp 90-101)
**Nemchenko, A.G.,** *See* Bibikov, G.G., 3:21017
**Nemov, V.V.,** Neoclassical diffusion in toroidal three-cut magnetic field, 3:22471
**Nerheim, N.M.,** Scaling a double-pulsed copper chloride laser to 10 mJ, 3:22034
**Nering, J.E.,** *See* Menasian, S.C., 3:22437
**Neufeld, R.D.,** *See* Johnson, G.E., 3:20904
**Neuhauser, K.S.,** *See* Sivinski, H.D., 3:21240
**Neumann, R.,** In-situ coal gasification. Part of the energy research program of the Federal government, 3:20867
**Neumann, W.M. Jr.,** Importance of feed gas conditioning, 3:21065 (CONF-770375—, pp 88-91)
**Nevezhin, O.A.,** *See* Grigor'ev, E.I., 3:21301
**Newkirk, H.W.,** *See* O'Connell, L.G., 3:21857
**Newman, D.H.,** *See* Dobson, P.S., 3:22060
**Newton, J.O.,** *See* Simon, R.S., 3:22369
**Neyaglov, A.V.,** *See* Mazagarov, A.M., 3:21086
**Nguyen, H.K.,** *See* Meyer, D.I., 3:22327
**Nicholson, D.L.,** Application of parameter estimation and hypothesis test for a generalized gamma distribution, 3:22142
**Nicholson, N.E.,** Method of removing sulfur dioxide from a gas, 3:20909
**Nicholson-Florence, M.B.,** *See* Castillo, R., 3:22657
**Nickel, H.,** *See* Linke, J., 3:21574
**Nickels, L.E.,** *See* Campen, G.L., 3:22603
**Nickola, P.W.,** Hanford 67-series: a volume of atmospheric field diffusion measurements, 3:22141 (PNL—2433)
**Nield, K.,** *See* Auer, I.P., 3:22335
*See* Hidaka, H., 3:22342
**Nielsen, J.,** Archaeological reconnaissance of a proposed site for the Waste Isolation Plant (WIPP), 3:21167 (SAND—77-7024)
**Nieschmidt, E.B.,** *See* Dyer, N.C., 3:21623
**Nieva, R.,** Suboptimal control of a nuclear reactor using functional analysis, 3:21617
**Nika, Y.N.,** *See* Moskalenko, V.A., 3:22395
**Nikolic, D.,** *See* Antic, S., 3:21004
**Nikulin, V.Ya.,** *See* Gribkov, V.A., 3:22415
**Nilson, R.H.,** *See* Lee, D.O., 3:21644
**Nishihara, H.,** Acoustic emission in subcooled nucleate pool boiling, 3:21591
Measurement and analysis of neutron spectrum in spherical pile of thoria, 3:21147
**Nitz, D.,** *See* Akimov, Y., 3:22333
**Noel, G.T.,** *See* Graham, C.D., 3:21281
**Noon, E.L.,** *See* Campbell, R.W., 3:22128
**Nordstroem, S.,** Increasing energy consumption: will the plans be followed, 3:21750
**Norem, J.,** *See* Brooks, J.N., 3:22676
**Norhammar, U.,** *See* Nordstroem, S., 3:21750
**Northrop, D.A.,** Instrumentation and process control development for in situ coal gasification. Tenth and eleventh quarters' report: March—August 1977, 3:20862 (SAND—77-1821)
**Nosov, B.N.,** *See* Shmukler, B.I., 3:21493
**Noton, B.R.,** *See* Ollila, R.G., 3:21801
**Novak, M.M.,** *See* Castillo, R., 3:22657
**Novikov, V.E.,** *See* Karas', V.I., 3:22394
**Noyes, P.,** New look at the nuclear force, 3:22380 (SLAC-PUB—1601)
**Nozik, A.J.,** Photoelectrolysis of water by solar radiation, 3:21315
**Nummik, R.,** *See* Szomodyi, A., 3:22336
**Nunziato, J.W.,** Thermal ignition time for homogeneous explosives involving two parallel reactions, 3:22136
**Nuzzi, R.,** Effects of water soluble extracts of oil on phytoplankton, 3:22271 (CONF-730386—, pp 809-813)
**Nye, A.E.T.,** *See* Turner, H.J., 3:21577
**Nyein, R.K.,** Occurrence, prediction and control of geopressures on the northwest shelf of Australia, 3:20978

## O

**O'Connell, L.G.,** Utilization of flywheels for the evolution of high-performance electric vehicles, 3:21857 (UCRL—52346)
**O'Fallon, N.,** *See* Duffey, D., 3:21924
**O'Fallon, N.M.,** *See* Herzenberg, C.L., 3:20887
**O'Hara, J.B.,** Cresap Test Center inspection and acceptance services. R and D report No. 82, interim report No. 8, 3:20877 (FE—1234-8)
**O'Hara, S.,** *See* Dobson, P.S., 3:22060
**O'Neal, W.C.,** *See* Manes, K.R., 3:22647
**O'Neill, A.J.,** *See* Vizcaino, H.P., 3:21122
**O'Neill, M.J.,** Analytical and experimental study of total internal reflection prismatic panels for solar energy concentrators, 3:21381
**Oakes, R.J.,** *See* Mikaelian, K.O., 3:22343
**Oberle, R.D.,** *See* Duncan, D.A., 3:20875
**Oblasova, L.Z.,** Effect of naphthols on the thermal stability of fuels, 3:21054 (N—77-26322)
**Oboznyi, V.F.,** Experience in the use of polyurethane foam as a filter material in treating oil-containing wastewaters, 3:21014
**Obright, W.,** *See* Hebrank, J., 3:21705
**Ocerales, Y.,** *See* Bouteau, F., 3:22389
**Odette, G.R.,** *See* Heinrich, R.R., 3:22677
**Ogino, T.,** *See* Kikuchi, Y., 3:21592
**Ogorodnikov, P.I.,** Some results of investigation of the functioning of antivibration devices, 3:20963
**Ogorodnikova, G.N.,** *See* Ogorodnikov, P.I., 3:20963
**Ohnishi, M.,** Effects of impurities on alpha particle loss in a tokamak reactor, 3:22587
**Ohnuki, S.,** Theoretical analysis on radiation and reception characteristics of an oblate spheroidal antenna for electron plasma waves, 3:22429
**Ohnuma, T.,** *See* Fujita, T., 3:22490
*See* Ohnuki, S., 3:22429
**Olen, C.T.,** Resonance energy neutron radiography techniques, 3:22074
**Okabayashi, M.,** *See* Cohn, D.R., 3:22600
**Okuda, H.,** Higher-order multipoles and splines in plasma simulations, 3:22457 (PPPL—1404)
*See* Cheng, C.Z., 3:22477
**Ol'khovskii, G.G.,** Investigation of the transient conditions of operation of the GT-100-750-2 gas turbines, 3:21507
**Olaussson, A.,** *See* Stejskal, J., 3:21177
**Olefir, N.A.,** *See* Kostyuk, V.I., 3:21016
**Oliphant, W.F.,** *See* Johnson, D.J., 3:22427
**Olivier, J.C.,** *See* Corfu, R., 3:22367
**Ollila, R.G.,** Factors affecting the corporate decision making process of air transport manufacturers. Final report, 3:21801 (N—77-27020)
**Olmer, C.,** *See* Gelbke, C.K., 3:22374
*See* Stokstad, R.G., 3:22356
**Olsen, C.R.,** *See* Biscaye, P.E., 3:22215
**Olsen, L.C.,** Model calculations for metal-insulator-semiconductor solar cells, 3:21284
**Olsen, S.L.,** *See* Akimov, Y., 3:22333
**Omidvar, K.,** *See* Bussard, R.W., 3:22297
**Oothoudt, M.A.,** *See* Blanpied, G.S., 3:22354
**Oraevskii, A.N.,** Gasdynamic laser using a $D_2$—HCl—He mixture, 3:22041
**Orlov, V.K.,** *See* Borisov, B.N., 3:22049
**Orphan, V.J.,** *See* Reynolds, G.M., 3:21922
**Ortabasi, U.,** Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975—August 31, 1975, 3:21367 (COO/2608—1)
Internal cusp reflector for an evacuated tubular heat pipe solar thermal collector, 3:21376
**Orzechowski, T.,** *See* Hooper, E.B. Jr., 3:22621
**Oshchenkov, V.P.,** *See* Baratov, D.G., 3:22110
**Ostrovskii, S.A.,** *See* Ol'khovskii, G.G., 3:21507
**Oswald, W.J.,** *See* Benemann, J.R., 3:21311
**Othmer, P.,** Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**Ott, K.O.,** *See* Theofanous, T.G., 3:21668
**Otta, H.,** *See* Tulecki, J., 3:22259
**Ouchi, K.,** Solvolysis extraction using quinoline and phenol resin as coal model, 3:20885
**Ovchinnikov, V.S.,** *See* Grigor'ev, E.I., 3:21301
**Ozaki, Y.,** *See* Kikuchi, Y., 3:21592
**Ozarski, R.,** *See* Rienecker, F., 3:22645

## P

**Pack, J.L.,** *See* Rogoff, G.L., 3:22018
**Page, D.,** Method and device for determining the sulfur content of coal, 3:20897
**Paiss, Y.,** *See* Zigler, A., 3:22475
**Paizenko, M.I.,** *See* Kostyuk, V.I., 3:21016
**Palmedo, P.F.,** *See* Carroll, T.O., 3:21679
**Pan'kova, T.V.,** *See* Grinberg, I.V., 3:21106
**Pan, V.M.,** Shock synthesis of superconducting $Ta_3Si$, 3:21913

**Pan, Y.L.,** Problems with rho R measurements: what are the ways out, 3:21237 (UCRL—79772)
**Pancirov, R.J.,** Analytical methods for polynuclear aromatic hydrocarbons in crude oils, heating oils, and marine tissues, 3:21052
**Pang, C.S.,** Viscous drag on mobile dislocations in type-II superconductors, 3:21886
**Pankov, I.I.,** *See* Troyanovskii, B.M., 3:21611
**Panovko, M.Y.,** *See* Beloglazov, A.A., 3:21768
**Pantell, R.H.,** *See* Chen, C.K., 3:22313
**Papadopoulos, K.,** *See* Huba, J.D., 3:22487
**Papina, L.,** *See* Szomodyi, A., 3:22336
**Papok, K.K.,** Effect of polymeric additives and viscous oil components on varnish-forming properties of all-season oils, 3:20998
**Parail, V.V.,** *See* Klima, R., 3:22414
**Parker, R.H.,** Application of nuclear techniques for measurements near Jupiter, 3:22306
**Parker, R.R.,** *See* Cohn, D.R., 3:22600
**Parks, C.E.,** *See* Jones, R.C. Jr., 3:21639
*See* Treventi, P.A., 3:21638
**Parks, N.J.,** Cyclotron production of $^{13}N$ compounds for environmental and biological research, 3:21997
**Parshin, A.A.,** Present-day problems of boiler engineering, 3:21492
**Parsons, F.A.,** *See* Bradley, R.F., 3:21165
**Pashkovskii, M.V.,** *See* Brudnyi, V.N., 3:21897
**Pasqualetti, M.J.,** Geographical environmental analysis. Final report, 3:21419
**Patrick, S.L.,** *See* Reily, J.C., 3:21270
**Patten, B.G.,** *See* Clark, R.C. Jr., 3:22270
**Patterson, G.K.,** Modeling complex chemical reactions in flows with turbulent, diffusive mixing, 3:22068 (UCRL—79770)
**Patton, H.G.,** *See* Stowers, I.F., 3:22026
**Pavlenko, V.P.,** Many-wave explosive instability, 3:22492
**Pavlova, L.S.,** Determination of electron velocity distribution from the microwave emission of a low-temperature plasma, 3:22438
**Paxson, E.,** Radial parfait core design study, 3:21590 (WARD—353)
**Pchelin, V.E.,** *See* Miroshnichenko, A.M., 3:20844
**Pearce, D.L.,** Selective hydrogen sulfide removal, 3:21075 (CONF-7603113—, pp K1-K24)
**Pearce, R.L.,** *See* Asperger, R.G., 3:21068
**Pearce, W.S.,** Method of combining diesel-generator set detailed component models into a composite model, 3:21601
**Pearlman, J.S.,** Emission of rf radiation from laser-produced plasmas, 3:22511
**Pearlstein, S.,** *See* Burrows, T.W., 3:22290
**Pearson, R.O.,** Use of geothermal heat for sugar refining. Final report, October 1, 1976—May 31, 1977, 3:21450 (SAN/1317—3)
**Pease, R.S.,** Potential of controlled nuclear fusion, 3:22550
**Pechan, E.H.,** 1985 air pollution emissions, 3:22144 (DOE/PE—0001)
**Peker, L.,** *See* Meyer, R.A., 3:22357
**Pelissier, J.,** *See* Pollmann, E., 3:21145
**Pellarin, D.J.,** Pulsed reactivity measurements of large $^{235}U$—Al castings in $H_2O$, 3:22011 (DP-MS—77-49)
**Pelletier, G.,** Renormalization method and singularities in the theory of Langmuir turbulence, 3:22520
**Peng, Y-K.M.,** Plasma engineering considerations for a medium-field ignition test reactor, 3:22561
**Peratt, A.L.,** Detection and measurement of Post-Rosenbluth convective instability in MFTF with a hybrid $CO_2$ laser—heterodyne diagnostic system, 3:22423 (UCRL—52339)
**Pereira, N.R.,** Nonlinear development of lower hybrid cones, 3:22486
**Pereverzev, G.V.,** *See* Dnestrovskii, Yu.N., 3:22418
**Perez-Mendez, V.,** *See* Macdonald, B., 3:22124
**Perkowitz, S.,** Second international and winter school on submillimeter waves and their applications, 3:22067
**Perl, M.L.,** Properties of the proposed tau charged lepton, 3:22328
**Perry, C.R.,** *See* Jones, V.W., 3:21071
**Perry, D.G.,** Data analysis facility at LAMPF, 3:22118 (LA—7034-MS)
**Perry, E.H.,** *See* Hill, J.M., 3:21380
**Perry, R.B.,** *See* Brumbach, S.B., 3:21235
**Perry, R.T.,** *See* Conn, R.W., 3:22560
**Pershina, R.F.,** *See* Sirina, T.P., 3:21844
**Pertrosyan, V.I.,** Superconductivity of rapidly condensed films, 3:21888
**Petera, I.P.,** *See* Surkov, Yu.V., 3:21082
**Peterson, B.H.,** Background working levels and the remedial action guidelines, 3:22183 (HASL—325, pp 108-109)
**Peterson, J.R.,** *See* Brooks, R.D., 3:21482
**Peterson, R.J.,** *See* Morris, C.L., 3:22355
**Peterson, R.L.,** *See* Huffman, W.J., 3:21304
**Petkovic, P.,** *See* Jongsma, D., 3:20944
**Petrov, A.S.,** *See* Brudnyi, V.N., 3:21897
**Pettengill, G.,** *See* Schubert, G., 3:22303
**Petty, S.W.,** *See* Becker, F.E., 3:21753
*See* Demirjian, A., 3:21752
**Petviashvili, V.I.,** High-frequency diamagnetism and three-dimensional cyclotron solitons in a plasma, 3:22529
**Petzold, K.,** *See* Kunze, W., 3:21790
**Petzold, L.,** Methods for oscillating problems, 3:22690 (COO—2383-45)
**Pevgov, V.G.,** *See* Sharkov, V.F., 3:22054
**Pexton, R.L.,** Roots of two transcendental equations determining the frequency spectra of standing spherical electromagnetic waves, 3:22402
**Pfeifer, H.J.,** Experimental determination of the contrast of two interfering argon laser beams, 3:22022 (N—77-26490)
**Pfisterer, F.,** *See* Schock, H.W., 3:21287
**Phen, R.,** *See* Murphy, A., 3:20852
**Philippi, G.T.,** Proteins as a possible source material of low molecular weight petroleum hydrocarbons, 3:21261
**Phillion, D.W.,** *See* Glaros, S.S., 3:22649
**Phillips, C.R.,** Radon and radon daughter measurements and methods utilized by EPA's Eastern Environmental Radiation Facility, 3:22189 (HASL—325, pp 4-5)
**Phillips, G.C.,** *See* Kropschot, R.H., 3:20841
**Phillips, K.E.,** Granular bed filter development program: particle sampling facility operation, 3:20902 (FE—2579-10)
**Phillips, W.R.,** *See* May, R.T., 3:21123
**Pichakhchi, I.D.,** *See* Oboznyi, V.F., 3:21014
**Pick, J.B.,** Population analysis relative to geothermal energy development, Imperial County, California, 3:21416
**Pickard, P.S.,** User's manual for the CDC-6600 version of AMPX, 3:22385 (SAND—77-1148)
**Piel, A.,** *See* Himmel, G., 3:22452
**Pierce, E.T.,** *See* Rossiter, W.J. Jr, 3:21773
**Piestrup, M.A.,** *See* Chen, C.K., 3:22313
**Pietsch, W.J.,** *See* Gemmell, D.S., 3:22311
**Pigford, T.H.,** Denatured fuel cycles for safeguards control, 3:21233
**Pilkiewicz, F.G.,** *See* Prestwich, G.D., 3:21980
**Pimenov, V.P.,** *See* Oraevskii, A.N., 3:22041
**Pinkston, W.T.,** *See* Deyoung, R.J., 3:22021
**Pion, M.,** Degradation characteristics of cw lasers with specific growth defects, 3:22059
**Piotrowska, E.,** Assessment of current practice with regard to charge preheating in electrometallurgy, 3:21838
**Pirk, H.,** Method and device for the dry preparation of ceramic uranium dioxide nuclear fuel wastes, 3:21148
**Pitzer, K.S.,** Electrolyte theory: improvements since Debye and Hueckel, 3:21987
**Plaksin, O.T.,** *See* Shnitser, I.N., 3:21496
**Plasil, F.,** *See* Britt, H.C., 3:22364
**Pletnev, G.P.,** Optimalizing control of firing conditions in the furnace of drum-type steam generators, 3:21509
**Plisak, V.F.,** *See* Ogorodnikov, P.I., 3:20963
**Pluer, R.,** Design and experience in the operation of the Danziger Strasse gas- and oil-fired thermal Power Plant of the Oberhausen Power Supply Company, 3:21518
**Pobereskin, M.,** *See* Schwendiman, L.S., 3:22013
**Podgurskaya, L.,** *See* Szomodyi, A., 3:22336
**Poetzl, K.,** *See* Reiter, R., 3:22191
**Poetzschke, M.,** Applying hafnium or hafnium alloys as material in plants for reprocessing irradiated nuclear fuels, 3:21161
**Poezd, D.F.,** *See* Zaitsev, V.A., 3:20993
**Pogosyan, A.V.,** *See* Dnestrovskii, Yu.N., 3:22418
**Pogutse, O.P.,** Energy principle and the kink instability in a toroidal plasma with a strong magnetic field, 3:22488 (ORNL-tr—4410)
**Poirier, B.W.,** Archaeological and historical investigations for energy facilities: a state of the art report, 3:21685 (TID—28070)
**Pokhmurskii, V.I.,** Increasing the endurance limit and corrosion resistance of light-alloy drill pipes, 3:20983
**Pollard, E.C.,** Basic aspects of radiation action on microorganisms. Final report for the period ending October 31, 1977, 3:22252 (COO—2362-27)
**Pollmann, E.,** Transmission electron microscopy of pyrocarbon coatings, 3:21145
**Poltoratskii, V.I.,** *See* Svechkarev, I.V., 3:21890
**Poluektov, V.P.,** *See* Grigor'ev, E.I., 3:21301
**Polyakov, E.F.,** *See* Emel'yanov, I.Ya., 3:21597
**Polyakov, V.M.,** *See* Pavlova, L.S., 3:22438
**Pomeroy, B.D.,** *See* Bass, R.R., 3:21480
*See* Brown, D.H., 3:21477, 3:21479
**Pommer, L.,** *See* Kahlert, G., 3:21842
**Poore, M.W.,** *See* Corwin, W.R., 3:22682
**Pope, D.P.,** *See* Graham, C.D., 3:21281
**Poperekova, L.,** *See* Szomodyi, A., 3:22336
**Popov, A.G.,** *See* Pan, V.M., 3:21913
**Popov, N.I.,** *See* Zhiryakov, B.M., 3:22046
**Popov, P.G.,** *See* Andreev, S.I., 3:22413
**Popov, V.K.,** *See* Myasoedov, N.F., 3:22629
**Popov, Y.M.,** *See* Voitik, M.G., 3:22042
**Popova, S.S.,** *See* Papok, K.K., 3:20998
**Popytayev, A.N.,** *See* Dyatlov, V.D., 3:22121
**Porges, K.G.,** *See* Herzenberg, C.L., 3:20887
**Porter, G.D.,** *See* Damm, C.C., 3:22543
**Porter, R.E.,** *See* Rump, W.M., 3:20953
**Porter, W.A.,** *See* Kilby, J.S., 3:21314
**Postnikova, N.G.,** *See* Zrelov, V.N., 3:21050
**Potapov, A.I.,** *See* Brudnyi, V.N., 3:21897
**Potter, G.,** *See* Leisey, F., 3:21091
**Pouder, R.,** *See* Carroll, T.O., 3:21679

**Pouget, J.P.,** *See* Hastings, J.M., 3:21914
**Poulos, N.E.,** *See* Walton, J.D. Jr., 3:21317
**Poulsen, P.,** *See* Hooper, E.B. Jr., 3:22621
**Powell, C.,** *See* Menasian, S.C., 3:22437
**Powell, J.,** *See* Yu, W.S., 3:22612
**Powell, J.R.,** *See* Majumdar, D., 3:22632
**Pozin, L.Z.,** Investigation of the quality of gas well cementing by detailed thermometry methods, 3:21083
**Praeg, W.F.,** *See* Wang, S.T., 3:22593
**Pratt, J.C.,** *See* Blanpied, G.S., 3:22354
**Prausnitz, J.M.,** *See* Donohue, M.D., 3:21040
**Prelas, M.A.,** Direct nuclear-pumped laser approaching feedback laser fusion needs, 3:22673
**Prelec, K.,** Magnetron discharge as a source of H-ions, 3:22115
Negative hydrogen ion sources for neutral beam injectors, 3:22613 (BNL—23389)
**Preses, J.M.,** Unimolecular decomposition of cyclo-$C_4F_8$ induced by a $CO_2$ TEA laser, 3:21989
**Prestwich, G.D.,** Kempene-1 and -2, unusual tetracyclic diterpenes from Nasutitermes termite soldiers, 3:21980
**Price, V.,** *See* Ferguson, R.B., 3:21119
**Price, W.G. Jr.,** Cost of tritium bred in a critical fission reactor, 3:22628
**Prichard, H.M.,** *See* Gesell, T.F., 3:22221
**Prilipko, I.P.,** Investigations into the carbonaceous reservoirs of the Paleozoic deposit of the South East Dnieper-Donetsk hollow, 3:20945
**Primak, R.G.,** Thermogravimetric investigation of oxidative polycondensation of petroleum residual stocks, 3:21048
**Prishlyak, A.M.,** *See* Pokhmurskii, V.I., 3:20983
**Probert, S.D.,** *See* Baker, G., 3:21777
*See* Ramsden, K.W., 3:22004
**Proshletsov, A.P.,** *See* Es'kov, A.G., 3:22601
**Prosnitz, D.,** Stimulated emission at 9.75 μm following two-photon excitation of methyl fluoride, 3:22028
**Protic, R.,** *See* Antic, S., 3:21004
**Protze, K.H.,** Electric pipe heater, 3:21778
**Przhiyalkovskii, M.M.,** *See* Lokshin, V.A., 3:21508
**Pukhal'skaya, V.A.,** *See* Miroshnichenko, A.M., 3:20844
**Pulfrey, D.L.,** Minority carrier MIS solar cell, 3:21289
**Pulsifer, A.H.,** Electrofluid gasification of coal with nuclear energy, 3:20864
**Purcell, W.L.,** *See* Heeb, C.M., 3:21204
**Purdy, C.M.,** *See* Morabito, J.J., 3:21593
**Pyle, R.V.,** *See* Berkner, K.H., 3:22619
**Pyles, T.K.,** *See* Bretschneider, C.L., 3:21327
**Pyrdol, J.J.,** *See* Salkov, H.R., 3:21727

## Q

**Quincy, E.A.,** Remote electromagnetic sensing of underground coal burns. Quarterly technical progress report, March—May 1977, 3:20857 (FE—2414-4)
**Quinif, Y.,** *See* Charlet, J.M., 3:21133
**Quinn, D.J.,** *See* Barrager, S.M., 3:21427
**Quyen, N.C.,** *See* Braekman-Danheux, C., 3:20896

## R

**Raabe, O.G.,** *See* Goldman, M., 3:22255
**Rabbe, P.,** Stainless steel thick plates for light-water reactors, 3:21565
**Rabe, F.T.,** Uncertainties in estimates of fleet average fuel economy: a statistical evaluation. Final report November 1975—November 1976, 3:21804 (PB—270025)
**Rabiner, Ya.P.,** *See* Tager, S.A., 3:20930
**Rabinovich, A.V.,** Control system of the T-250/300-240 steam turbine, 3:21502
**Rabinovich, M.I.,** *See* Gol'tsova, Yu.K., 3:22505
**Rabotaev, V.G.,** *See* Samoilovich, G.S., 3:21505
**Radyuk, R.I.,** *See* Vdovina, E.D., 3:21178
**Ragent, B.,** *See* Knollenberg, R.G., 3:22305
**Rahman, A.,** *See* Stillinger, F.H., 3:22316
**Rahman, S.,** Dispatch of nuclear power plants, 3:21598
**Rai, K.S.,** Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967—September 1977, 3:22264 (COO—38-1838)
**Rainer, G.,** Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
**Rajkovic, D.,** *See* Antic, S., 3:21004
**Ralston, D.,** Catalytic activities and selectivities of $MoO_3$—$NiSO_4$ supported on various oxides for hydrocracking of solvent refined lignite. Novel low surface area active catalysts, 3:20881
**Ramachandran, G.,** Economic analyses of geothermal energy development in California, 3:21428 (SAN—115P108-1(Vol.1))
**Ramage, J.G.,** *See* Kinderman, A.J., 3:22695
**Ramanna, R.,** MHD power generation: a technology of future, 3:21751
**Ramaty, R.,** *See* Bussard, R.W., 3:22297
**Ramsden, K.W.,** Optimizing the design and use of an air-driven water pump, 3:22004
**Randall, W.E.,** Multiple use potential along power transmission rights of way, 3:21546
**Rao, K.R.,** *See* Heinzel, F., 3:22261
**Rao, S.,** *See* Bender, D.J., 3:22542
**Raporport, I.,** *See* Szomodyi, A., 3:22336
**Rapp, H.,** Experimental investigation of the operating characteristic of a plasma focus, 3:22447 (LA-tr—77-69)
**Raptis, A.C.,** Signal analysis method using cross-correlation of turbulence flow signals to determine calibration of permanent magnet sodium flowmeters, 3:21579 (CONF-771023—23)
**Rasmussen, I.,** Uranium recovery trials at Risoe, 3:21994
**Rasmussen, R.A.,** Hydrocarbon and oxidant chemistry observed at a site near St. Louis. Final report 30 June 1975—30 June 1976, 3:22145 (PB—269559)
**Rastsvetalov, Y.N.,** *See* Baratov, D.G., 3:22116
**Rather, J.D.G.,** Investigation of possibilities for solar powered high energy lasers in space. Final report, 3:22020 (N—77-26478)
**Ratkowski, A.J.,** *See* Gemmell, D.S., 3:22311
**Ratner, B.D.,** Blood compatibility of radiation-grafted hydrogels, 3:22250
**Raupach, D.C.,** *See* Jester, W.A., 3:22218
**Raven, A.,** *See* Rumsby, P.T., 3:22512
**Ray, L.,** *See* Blanpied, G.S., 3:22354
**Ray, P.S.,** Thermalisation of energetic charged particles in fusion plasma with quantum electrodynamic considerations, 3:22585
*See* Castillo, R., 3:22657
**Raymond, K.N.,** *See* Baker, E.C., 3:21955
**Razdaibedin, A.S.,** *See* Kostyuk, V.I., 3:21016
**Razgaitis, R.,** Analysis of the high-temperature particulate collection problem, 3:20922 (ANL—77-14)
**Razumova, K.A.,** *See* Alikaev, V.V., 3:22453, 3:22504
**Rea, K.H.,** Environmental investigations associated with the LASL hot dry rock geothermal energy development project, 3:21432 (LA—6972)
**Ready, J.F.,** Industrial applications of high power laser technology, 3:22065
**Reddoch, T.W.,** *See* Robertson, F.R., 3:21569
**Reddy, G.N.,** Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024—3)
**Reedy, R.C.,** Experimental determination of cosmic-ray particle fluxes, 3:22294
**Rees, I.F.,** *See* Judd, B.T., 3:21868
**Reese, D.R.,** *See* Reily, J.C., 3:21270
**Rehwinkel, H.,** *See* Bammert, K., 3:21516
**Reich, C.W.,** Nuclear structure studies utilizing LAMPF. Annual progress report, 3:22361 (TREE—1115)
*See* Greenwood, R.C., 3:22360
*See* Helmer, R.G., 3:22359
**Reid, B.E.,** *See* May, R.T., 3:21123
**Reid, F.L.,** Commercial feasibility of fusion power based on the tokamak concept, 3:22557
**Reid, R.L.,** Measurements on the effect of planar reflectors on the flux received by flat-plate collectors, 3:21379
**Reihl, J.D.,** Installation of a commercially-available pre-packaged hydronic solar heating system by a homeowner, 3:21349
**Reilly, J.J.,** *See* Hoffman, K.C., 3:21255
**Reily, J.C.,** Economic trade-offs between the performance of collector thermal performance tests on a solar simulator as opposed to outdoor testing, 3:21270
**Reimer, G.M.,** *See* Carpenter, B.S., 3:21926
*See* Friedman, I., 3:21136
**Reiter, R.,** Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974—31 July 1975, 3:22191 (NYO—3425-14)
**Relotius, P.C.,** Offshore terminal with underground storage at sea, 3:21056
**Rennebeck, K.,** Prefabricated houses with indoor swimming pool heated by heat pump, 3:21789
**Renoux, A.,** *See* Duport, P., 3:22267
**Renton, J.J.,** Prediction model for compositional changes within a coal from core data. Quarterly report, September—December 1976, 3:20891 (FE—5065-2)
Some practical considerations in x-radiography, 3:21101 (MERC/SP—77/7)
**Repin, N.N.,** Principle of operation and method of calculating depulsators, 3:21081
**Reppen, N.D.,** *See* de Mello, R.W., 3:22549
**Reuscher, J.A.,** *See* Schmidt, T.R., 3:21625
**Reutov, V.P.,** *See* Gol'tsova, Yu.K., 3:22505
**Reynolds, G.M.,** System optimization for prompt-neutron activation analysis of coal, 3:21922
**Reynolds, J.G.,** Structure of uranyl nitrate-bis(tetrahydrofuan), 3:21995
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
**Reynolds, J.S.,** *See* Baker, M.S., 3:21336
**Reznik, V.I.,** Some problems of control of intermediate superheating of steam, 3:21495
**Rezvanov, V.I.,** *See* Sergeev, A.D., 3:20992

**Rhee, K.H.,** *See* Brown, F.R., 3:20846
**Rhinehammer, T.B.,** *See* Watkins, R.A., 3:22012
**Rhoads, G.G.,** *See* Robertson, T.L., 3:22246
**Rhodes, C.K.,** *See* Prosnitz, D., 3:22028
**Rianda, R.,** *See* Frueholz, R.P., 3:22320
**Richards, B.,** *See* Stone, D.S., 3:22450
**Richards, N.A.,** Old field vegetation as an inhibitor of tree vegetation, 3:22199
**Richardson, D.M.,** *See* Bamberger, C.E., 3:21946
**Richman, J.,** *See* Friedland, B., 3:22127
**Richter, K.,** *See* Benedict, U., 3:21150
**Ricou, J.,** Uranium ore crushing, 3:21137
**Ridge, R.J.,** *See* Blanpied, G.S., 3:22354
**Riemer, H.L.,** No uranium OPEC to be evoked as a phantom, 3:21747
**Rienecker, F.,** Shiva optical diagnostics, 3:22645 (UCRL—79776)
*See* Manes, K.R., 3:22647
**Ries, D.R.,** *See* Hampel, V.E., 3:22697
**Rimstidt, J.D.,** Development of geothermal energy: some problems, 3:21447
**Ringlee, R.J.,** *See* de Mello, R.W., 3:22549
**Ripperton, L.A.,** Oxidant-precursor relationships during pollutant transport conditions. An outdoor smog chamber study. Final report May 1974—November 1975, 3:22147 (PB—269877)
**Rippey, W.,** *See* Hebrank, J., 3:21705
**Ristinen, R.A.,** *See* Morris, C.L., 3:22355
**Ritter, G.,** Investigation of special resins for the extraction-chromatogaphic separation of Np and Pu from the process stream of a reprocessing plant for HTR fuel elements, 3:21158 (GERHTR—181)
**Rivkin, S.L.,** Equation of state of water and steam for computer aided calculation of processes and equipment of power plants, 3:21500
**Roach, P.D.,** Positive ion mobility in normal $^3$He, 3:22325
**Roach, P.R.,** *See* Roach, P.D., 3:22325
**Robards, R.F.,** *See* Holliden, G.A., 3:21525
**Robbins, J.A.,** *See* Edgington, D.N., 3:22227
**Robens, E.,** *See* Behret, H., 3:21770
**Roberson, C.W.,** Magnetic field reversal induced by an intense rotating electron beam in an initially neutral gas, 3:22405
**Roberts, A.A.,** *See* Friedman, I., 3:21136
**Roberts, M.,** Oak Ridge TNS Program 1976—1977. Integration of engineering reality brings us closer to realizable reactor, 3:22534 (CONF-771029—150)
**Robertson, A.S.,** *See* Corman, J.C., 3:21476
**Robertson, D.E.,** Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean, 3:21925
**Robertson, F.R.,** Investigation of optimal control strategies to an integral economizer U-tube steam generator, 3:21569
**Robertson, J.A.,** Blind River uranium deposits: the ores and their setting, 3:21110 (MP—65)
**Robertson, J.E.,** Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report, 3:21369 (N—77-26610)
**Robertson, T.L.,** Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22246
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247
**Robinson, B.W.,** *See* Kusakabe, M., 3:21457
**Robinson, I.J.,** *See* Magasanik, D., 3:21111
**Robinson, J.,** Practical oil spill control training school, 3:21032
**Robinson, L.,** Method for desulfurizing char by acid washing and treatment with hydrogen gas, 3:20847
**Robinson, R.L.,** *See* McGowan, F.K., 3:22370
**Robison, W.L.,** *See* Colsher, C.S., 3:22201
**Robson, A.E.,** Conceptual LINUS fusion reactor, 3:22566
**Robson, D.,** *See* Managoli, V., 3:22371
**Rocheleau, R.E.,** *See* Bretschneider, C.L., 3:21327
**Rock, R.L.,** Radon/radon-daughter measurement methods and instrumentation, 3:22164 (HASL—325, pp 2-3)
**Rode, J.S.,** Preliminary maintainability analysis of the HTGR dry head-end reprocessing systems, 3:21151 (GA-A—14678)
**Rodenburg, W.W.,** Calorimetric assay of plutonium. Technical report, 3:21220 (PB—270656)
**Roderick, T.H.,** Improved mutagen-testing systems in mice. Progress report, 1 June 1976—31 August 1977, 3:22238 (COO—3267-15)
**Rodionov, N.B.,** *See* Oraevskii, A.N., 3:22041
**Roepenack, H.,** *See* Pirk, H., 3:21148
**Rogers, D.R.,** *See* Seabaugh, P.W., 3:21232
**Rogers, L.A.,** *See* Black, A.D., 3:20952
**Rogers, V.C.,** Radiological criteria for the phase II inactive mill tailings program, 3:21207
**Rogoff, G.L.,** Laser discharges in attaching gases, June 25, 1976—June 24, 1977. Final report, 3:22018 (COO—4030-4)
**Rohde, K.L.,** *See* Slansky, C.M., 3:21169
**Romanova, T.V.,** *See* Papok, K.K., 3:20998
**Rome, J.A.,** *See* Peng, Y-K.M., 3:22561
**Rose, A.,** Economic impact of geothermal energy development, 3:21429
**Rose, L.C.,** *See* Hamrick, J.T., 3:20960
**Rose, P.,** *See* Hoffman, A., 3:22569
**Roshchin, A.A.,** *See* Afonin, A.G., 3:22117
**Rossel, J.,** *See* Corfu, R., 3:22367
**Rossi, J.A.,** In/sub 1-x/Ga/sub x/As/sub y/P/sub 1-y/-InP double-heterostructure lasers, 3:22063
**Rossinskii, V.M.,** *See* Malyavinskii, L.V., 3:21000
**Rossiter, W.J. Jr,** Urea-formaldehyde based foam insulations: an assessment of their properties and performance. Final report, 3:21773 (PB—269779)
**Rossow, H.E.,** *See* Lane, G.A., 3:21672
**Rostoker, N.,** *See* Roberson, C.W., 3:22405
**Rosynek, M.P.,** Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976—July 31, 1977, 3:20858 (FE—2467-4)
**Roux, F.,** Cast channel heads in low alloy steel for PWR steam generators, 3:21567
**Rowson, J.W.,** Radioisotopic x-ray analysis of uranium ores using Compton scatter for matrix compensation, 3:21934
**Roy, D.M.,** Borehole cement and rock properties studies: progress report, October 1, 1976—September 30, 1977, 3:21190 (Y/OWI/SUB—4091/6)
**Rozenberg, S.Sh.,** *See* Marchenko, Yu.A., 3:21497
**Rubanovich, I.M.,** *See* Grigor'ev, E.I., 3:21301
**Rubin, M.P.,** Applicability of accepted diffusion models to near stack dose calculations, 3:22193
**Rubin, N.B.,** *See* Ageev, A.I., 3:22107, 3:22108
**Ruch, R.R.,** Application of neutron activation analysis to coal research, 3:21919
**Ruffa, G.J.,** *See* Joss, P.C., 3:22300
**Ruhla, C.,** Perspectives on geothermal energy in France, 3:21396
**Rump, W.M.,** Supply of carbon dioxide for enhanced oil recovery. Final report, October 15, 1976—September 1, 1977, 3:20953 (FE—2515-10)
**Rumsby, P.T.,** Anisotropic fast electron emission from a microwave irradiated plasma slab, 3:22512
**Rupert, V.C.,** Particle and x-ray energy measurements in laser-plasma interaction experiments, 3:22428
*See* Glaros, S.S., 3:22649
**Russell, B.D.,** Application of microcomputers to the protection and control of power system substations, 3:21541
**Russell, G.R.,** *See* Nerheim, N.M., 3:22034
**Russell, R.J.,** Development of plating thickness standards for the physical vapor deposition of aluminum on Kapton, 3:21873 (BDX—613-1634(Rev.))
**Ryabikov, S.V.,** *See* Grigor'ev, E.I., 3:21301
**Ryan, J.D.,** *See* Hebrank, J., 3:21705
**Ryan, R.G.,** State side of the siting equation: some case studies, 3:21621
**Ryan, R.M.,** *See* Malaviya, B.K., 3:21663
**Rye, R.R.,** *See* White, J.M., 3:21966
**Rykov, V.L.,** *See* Baratov, D.G., 3:22109, 3:22110
**Rylander, H.G.,** *See* Weldon, W.F., 3:22604
**Rzabekov, I.N.,** Simplified calculation of rectification column minimum reflux conditions, 3:20991
**Rzaev, R.A.,** *See* Baratov, D.G., 3:22109, 3:22110, 3:22116
**Rzheznikov, Yu.V.,** Determination on a static model of the stiffness factor of the transverse circulation force in steam turbines, 3:21506

## S

**Saaski, E.W.,** Use of two-phase heat transfer for improved transformer cooling. Final report, 3:21530 (EPRI-EL—588)
**Sabelli, C.,** *See* Capasso, A., 3:21511
**Sabin, R.J.,** *See* Moore, R., 3:21340
**Sackett, K.E.,** *See* Esparza, V., 3:21647
*See* Gillins, R.L., 3:21645
**Sadovnik, I.,** *See* Becker, F.E., 3:21753
**Safonov, V.M.,** *See* Pletnev, G.P., 3:21509
**Saha, H.,** *See* Bhattacharya, K., 3:21288
**Sahu, R.P.,** Vacancy properties in gold, 3:21877 (CONF-761027—25)
**Saigo, T.,** Casings for geothermal wells, 3:21443
**Saint-Hilaire, G.,** Interferometry and luminosity measurements on a $CO_2$ laser plasma focus, 3:22426
**Saito, J.,** *See* Tabuchi, A., 3:22258
**Saito, S.,** Evaluation of effects of finite mixing time and non-condensable gas on fuel—sodium interactions, 3:21656
*See* Arai, Y., 3:20989
**Saito, T.,** *See* Hisamasu, T., 3:20908
**Sakharov, A.M.,** *See* Greil', A.D., 3:21501
**Sakharov, V.P.,** *See* Baratov, D.G., 3:22109
**Salant, R.F.,** Standpipe-bubbler pump level control study system design layout (Task A) W.P. 4413. Engineering memorandum No. 0153, 3:21589 (TID—27895)
**Salieva, R.B.,** Simulation algorithms and their realization by digital computer for calculation of wind- and solar-plant storage-service capacity, 3:21670
**Salk, J.,** *See* Schaefer, G., 3:22038
**Salkov, H.R.,** Status of coal supply contracts for new electric generating units, 1976—1985, 3:21727 (TID—28066)

**Saltanov, G.A.,** *See* Deich, M.E., 3:21503
**Salzano, F.J.,** *See* Hoffman, K.C., 3:21255
**Samarenko, V.N.,** *See* Rabinovich, A.V., 3:21502
**Samollov, A.V.,** *See* Baratov, D.G., 3:22109, 3:22110, 3:22116
**Samollovich, G.S.,** Profile losses in unsteady flow past active rotor blades, 3:21505
**Samson, J.C.,** Optical measurements of laser-detonated shock waves in thin lithium wires, 3:22473
**Samsonov, B.V.,** *See* Spiridonov, Yu.G., 3:21902
**Sandacz, A.,** *See* Akimov, Y., 3:22333
**Sandberg, J.,** *See* Menasian, S.C., 3:22437
**Sandell, N.,** *See* Athans, M., 3:21539
**Sanders, J.W.,** Growth-stage scaling model for the wind-driven sea, 3:22289
**Sandovskii, V.B.,** *See* Marchenko, Yu.A., 3:21497
**SanFilippo, G.P.,** Oil recovery by carbon dioxide injection. Annual report, July 1976—July 1977, 3:20954 (ORO—5301-18)
**Sanjurjo, A.,** *See* Kapur, V.K., 3:21276
**Santoro, R.T.,** *See* Uckan, N.A., 3:22537
**Sapir, J.,** *See* Ensslin, N., 3:21230
**Sapunov, Y.M.,** *See* Baratov, D.G., 3:22109
**Sarantsev, V.P.,** *See* Ageev, A.I., 3:22107, 3:22108
**Sardakov, V.M.,** Collective processes in the case of injection of rapid neutral atoms in a tokamak with noncircular cross section, 3:22416 (ERDA-tr—316)
**Sardet, C.,** *See* Tardieu, A., 3:22232
**Sari, C.,** Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient, 3:21149
*See* Benedict, U., 3:21150
**Sarubbi, R.G.,** *See* Chen, J.C., 3:21772
**Sass, A.,** *See* Robinson, L., 3:20847
**Sato, H.,** *See* Tabuchi, A., 3:22258
**Sato, N.,** *See* Lutz, G.J., 3:21927
**Saunders, R.B. II,** Combustion of Alternative Fuel Study (CAFS), 3:21258 (SAN—1261/1)
**Savel'ev, I.I.,** *See* Nazarenko, M.M., 3:22043
**Savit, R.,** *See* Carlitz, R.D., 3:22329
**Sawdye, R.,** Reliability requirements for admissible radiological hazards from fusion reactors, 3:22633
**Saxena, A.M.,** Correction factors for neutron diffraction from lamellar structures, 3:22388
Multilayer neutron monochromators, 3:22387
**Sayer, R.O.,** *See* McGowan, F.K., 3:22370
**Scadron, M.D.,** *See* Gunion, J.F., 3:22352
**Scanu, A.M.,** *See* Tardieu, A., 3:22232
**Scarlett, J.,** *See* Nicholson, N.E., 3:20909
**Schabron, J.F.,** Separation of hydroaromatics and polycyclic aromatic hydrocarbons and determination of tetralin and naphthalene in coal-derived solvents, 3:20893
**Schadt, W.,** *See* Battist, L., 3:22122
**Schaedla, W.H.,** Symmetrical $\pi$ and T attenuators: design data for component power dissipation and resistance, 3:22079 (SAND—77-1599)
**Schaefer, G.,** Argon laser with wall stabilized transverse discharge, 3:22038
**Schaefer, H.F. III,** *See* Bauschlicher, C.W. Jr., 3:21981
**Schaefer III, H.F.,** *See* Mahan, B.H., 3:22321
**Schatz, W.,** *See* Murphy, A., 3:20852
**Schchelov, V.A.,** *See* Oraevskii, A.N., 3:22041
**Schechter, D.E.,** *See* Stirling, W.L., 3:22626
**Scheirman, W.L.,** Operating experience with amine absorber level control valves, 3:21076 (CONF-7603113—, pp L1-L2)
**Schemkes, W.,** *See* Kalus, D., 3:21795
**Scheppele, S.E.,** Mass spectrometric analytical services and research activities to support coal-liquid characterization research. Quarterly report, June 9—September 30, 1977, 3:20874 (BERC—0020-9)
**Scheuten, G.H.,** Topical problems in reprocessing nuclear fuels, 3:21157
**Schiager, K.J.,** 3R-WL air sampling survey meter, 3:22171 (HASL—325, pp 31-33)
**Schiller, E.A.,** Mineral exploration and mining in Brasil--1977, 3:20915
**Schiller, J.E.,** Nitrogen compounds in coal derived liquids, 3:20894
**Schilling, A.H.,** *See* Schuller, C.R., 3:21423
**Schilling, J.H.,** *See* Garside, L.J., 3:20982
**Schindler, R.E.,** Development of a fluidized-bed calciner and past-treatment processes for solidification of commercial fuel-reprocessing liquid wastes, 3:21170 (ICP—1136)
**Schlatter, R.,** *See* Dufresne, J., 3:21085
**Schlegel, R.L.,** *See* Abrams, L.A., 3:21211
**Schmelzbach, P.A.,** *See* Gruebler, W., 3:22338
**Schmidt, E.W.,** *See* Schwendiman, L.S., 3:22013
**Schmidt, H.E.,** *See* Benedict, U., 3:21150
**Schmidt, I.A.,** *See* Blankenbecler, R., 3:22381
**Schmidt, L.B.,** *See* West, E.D., 3:22023
**Schmidt, P.,** *See* Stejskal, J., 3:21177
**Schmidt, T.R.,** Recent operational history of the new Sandia Pulsed Reactor III (SPR III), 3:21625 (SAND—77-1116C)
**Schmidt-Kuester, W.J.,** Energy supply for the Federal Republic of Germany. Research and development for the energy supply, 3:21720
**Schmieder, H.,** Method for increasing the lifetime of an extraction medium used for reprocessing spent nuclear fuel and/or breeder materials, 3:21154
*See* Poetzschke, M., 3:21161
**Schmitz, H.,** Air-conditioning systems in hospitals, 3:21796
**Schmoelling, K.,** *See* Justi, E., 3:21368
**Schmutzer, E.,** Generation of electric and diffusion currents (magnetic fields) in arbitrarily moving media by electromagnetic radiation, 3:22463
**Schnechter, D.E.,** *See* Stirling, W.L., 3:22615
**Schneider, E.M.,** Coke-oven performance on coarsened charge, 3:20842
**Schneider, E.W.,** *See* Glascock, M.D., 3:22363
**Schneider, K.J.,** *See* Kabele, T.J., 3:21203
**Schock, H.W.,** Technology of large area $Cu_2S$-CdS solar cells, 3:21287
**Schoeffel, H.,** *See* Braeunlich, G., 3:21792
**Schoenau, G.J.,** *See* Besant, R.W., 3:21352
**Schoenborn, B.P.,** *See* Saxena, A.M., 3:22387, 3:22388
**Scholtz, G.,** *See* Stejskal, J., 3:21177
**Schreiner, P.,** *See* Farrar, G.R., 3:22330
**Schroeder, D.D.,** Modification of SEC 3000 bonder for electronic flame-off, 3:22077 (BDX—613-1875)
**Schroeder, L.,** Petroleum and natural gas exploration in the Federal Republic of Germany in 1976. On the basis of data and drilling results of petroleum companies with activities in the Federal Republic of Germany, 3:20939
**Schroeder, W.U.,** Damped heavy-ion collisions, 3:22382
**Schubert, G.,** Dynamics, winds, circulation and turbulence in the atmosphere of Venus, 3:22303
**Schuldt, S.B.,** *See* Zook, J.D., 3:21273
**Schuller, C.R.,** Legal, institutional, and political problems in producing electric power from geothermal resources in California, 3:21423
**Schulten, R.,** Water splitting for the production of non-polluting energy carriers, 3:21247
**Schultz, A.J.,** High-precision neutron diffraction investigation of the prototype biscyclopentadienyl transition metal hydride (eta$^5$-$C_5H_5)_2MoH_2$ and resolution of the structure in terms of modern bonding theory, 3:21951
X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts, 3:21935
**Schultz, K.R.,** *See* Bender, D.J., 3:22542
**Schulz, H.,** New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data, 3:20870
**Schulze, D.,** *See* Bollinger, H., 3:21876
**Schulze, K.P.,** Fuel elements for nuclear reactors from the cased chemical plant. High safety requirements on the reprocessing plant, 3:21160
**Schumacher, R.,** *See* Wong, A.Y., 3:22565
**Schuss, J.J.,** Measurements of the parametric decay of $CO_2$ laser radiation into plasma waves at quarter critical density using ruby laser Thomson scattering, 3:22420 (PPPL—1394)
**Schuster, G.B.,** *See* Hara, K., 3:21983
**Schuster, R.J.,** *See* Huempfner, R.A., 3:22209
**Schwab, J.,** Development program for an ionizer—precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report, 3:20899 (EPRI-FP—291(Vol.1))
Development program for an ionizer—precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:20900 (EPRI-FP—291(Vol.2))
**Schwager, I.,** Molecular weight and association of coal-derived asphaltenes, 3:20895
**Schwall, R.E.,** Mechanical design of ORPUS-3, 3:22591 (CONF-771029—149)
*See* Walker, M.S., 3:22592
**Schwarz, E.,** *See* Corfu, R., 3:22367
**Schwendiman, L.S.,** Study of plutonium oxide leak rates from shipping containers. Quarterly progress report, April 1, 1977—June 30, 1977, 3:22013 (BNWL—2260-3)
**Schwenterly, S.W.,** Performance of 4.2 K cryopumps in neutral beam injectors, 3:22684
**Schwob, J.L.,** *See* Zigler, A., 3:22475
**Scifres, D.R.,** *See* Burnham, R.D., 3:22062
**Scott, B.B.,** *See* Bretschneider, C.L., 3:21327
**Scott, C.B.,** Evaluation of BISO and TRISO coated $ThO_2$ fuel particles irradiated in HFIR capsules HT-12 through HT-15 and HT-17 through HT-19, 3:21571 (GA-A—13557)
**Scott, D.K.,** *See* Gelbke, C.K., 3:22374
**Scott, J.,** *See* Othmer, P., 3:21357
**Scott, M.L.,** Multilayer light scattering and the laser gyro, 3:22030
**Scott, R.L.,** Reportable occurrences at nuclear reactors and their causes, 3:21654

Review of safety-related occurrences in nuclear power plants as reported in 1976, 3:21653
**Scott, T.E.,** *See* Woods, C.M., 3:20879, 3:20880
**Scott, W.E.,** Australia examines gas industry's future, 3:21737
**Scott, W.G.,** *See* Farrar, G.R., 3:22330
**Seabaugh, P.W.,** Controllable unit approach to material control, 3:21232
**Seaborg, G.T.,** Travels in the new world. Volume III, 3:22403 (PUB—113(Vol.3))
*See* Keller, O.L. Jr., 3:22310
**Sears, M.B.,** *See* Witherspoon, J.P., 3:21206
**Secor, E.S.,** Coal recovery from bituminous coal surface mines in the eastern United States: a survey. Information circular, 3:20917 (PB—269914)
**Seed, T.J.,** *See* Wienke, B.R., 3:22469
**Seeger, A.,** Diffusion of light particles in metals, 3:22392
**Seeley, F.G.,** Problems in the separation of radium from uranium ore tailings, 3:21179
**Sefcik, J.A.,** *See* Sawdye, R., 3:22633
**Segaser, C.L.,** Heat recovery equipment for engines, 3:21847 (ANL/CES/TE—77-4)
Internal combustion piston engines, 3:21846 (ANL/CES/TE—77-1)
**Segler, S.L.,** *See* Akimov, Y., 3:22333
**Seiff, A.,** *See* Schubert, G., 3:22303
**Seifritz, W.,** Dynamical analysis of processes substituting fossil energy, 3:21599
**Seiler, F.,** *See* Conzett, H.E., 3:22383
**Sekiya, T.,** *See* Hisamasu, T., 3:20908
**Selby, J.M.,** *See* Moeller, D.W., 3:21202
**Self, S.A.,** *See* Eustis, R.H., 3:21765
**Seligman, C.,** Feedback as a means of decreasing residential energy consumption. Report PU/CES 34, 3:21784 (COO/2789—1)
**Sellgren, A.,** Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps, 3:22015 (STU—75-5234)
**Sells, G.C.,** Coal firing technology for existing side fired tunnel kilns, 3:21807 (CONF-770658—, pp 3-14)
**Selph, F.B.,** *See* Grunder, H.A., 3:22099
**Seltzer, S.M.,** *See* Dyer, C.S., 3:22293
*See* Yin, L.I., 3:22131
**Semena, M.G.,** Effect of the diameter and length of fibers on carcass heat conductivity of metal fiber wicks of heat pipes, 3:22005
**Semenov, A.S.,** *See* Basov, N.G., 3:22051
**Semenov, O.G.,** *See* Gribkov, V.A., 3:22415
**Semenov, V.N.,** *See* Es'kov, A.G., 3:22601
**Seminozhenko, V.P.,** *See* Karas', V.I., 3:22394
**Semunkin, Iu.F.,** *See* Guseva, K.I., 3:22113
**Semunkin, Yu.F.,** *See* Kvasha, A.I., 3:22112
**Sen, A.,** *See* Pereira, N.R., 3:22486
**Senjo, T.,** Process for separation of nitrogen oxides from waste gas, 3:20907
**Senoo, M.,** $SrTiO_3$ synthesis process for solidification of strontium-90, 3:21175
**Sens, J.C.,** *See* Kephart, R.D., 3:22334
**Seppala, L.,** *See* Rienecker, F., 3:22645
**Seraphin, L.,** Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**Sergeev, A.D.,** Investigation of the operation of a gas separation unit of a catalytic reforming installation, 3:20992
**Serlemitsos, P.,** *See* Swank, J., 3:22296
**Servant, J.,** Nuclear safety problems and their consequences on the materials used, 3:21214
Nuclear safety problems and their consequences for the materials used, 3:21657
**Sesonske, A.,** *See* Theofanous, T.G., 3:21668
**Sesyunin, N.A.,** *See* Lebedev, N.F., 3:20971
**Seth, K.K.,** *See* Blanpied, G.S., 3:22354
**Shabratov, V.G.,** *See* Ageev, A.I., 3:22108
**Shaeffer, D.L.,** *See* Hoffman, F.O., 3:22208
**Shaffer, J.H.,** Reaction of uranyl nitrate solutions with amberlite IRC-72 cation exchange resin at 30°C: a kinetic investigation for the HTGR fuel recycle plant, 3:21152 (ORNL/TM—5866)
**Shah, R.P.,** *See* Brown, D.H., 3:21477
*See* Harris, L.P., 3:21478
**Shakhverdiev, A.N.,** *See* Guseinov, S.O., 3:21045
**Shalaikin, A.F.,** Intensification of the operation of vertical gravity-type separators, 3:21080
**Shalashov, I.M.,** *See* Baratov, D.G., 3:22110
**Shamberger, R.C.,** Freight car management systems: a new way out of the car utilization dilemma, 3:21802
**Shamim, A.,** Diagnostics of an rf induction plasma torch with the aid of a magnetic probe, 3:22430
**Shampine, L.F.,** Starting an ODE solver, 3:22692 (SAND—77-1023)
**Shannon, T.E.,** Design approaches for enchancing the engineering feasibility of tokamak power reactors, 3:22572
**Shapiro, G.A.,** Investigation of conditions of operation of low-pressure sections of T-50-130 turbines with reduced ventilation steam passes, 3:21510
**Shapiro, I.I.,** *See* Schubert, G., 3:22303
**Shapiro, M.M.,** *See* Kipnis, Sh.Sh., 3:20898
**Shapiro, P.,** *See* Weaver, R., 3:22301
**Shapovalov, Yu.I.,** *See* Shnitser, I.N., 3:21496
**sharafutdinov, V.M.,** *See* Gerber, V.Ya., 3:21008
**Sharapov, V.I.,** *See* Zrelov, V.N., 3:21050
**Sharifov, R.R.,** Use of ozone in treatment and aftertreatment of refinery wastewaters, 3:21012
**Sharkov, V.F.,** Gas-discharge CO laser with a high specific output energy, 3:22054
*See* Andronov, G.A., 3:22047
**Sharma, J.K.,** *See* Tewari, D.P., 3:22493
**Sharma, R.P.,** *See* Tewari, D.P., 3:22493
**Shavratov, V.G.,** *See* Ageev, A.I., 3:22107
**Shcheglov, V.B.,** *See* Bokhan, P.A., 3:22050
**Shchelev, M.Ya.,** *See* Bryukhnevich, G.I., 3:22431
**Shchelkunov, F.S.,** *See* Miroshnichenko, A.M., 3:20844
**Shchetinina, N.A.,** *See* Guseva, K.I., 3:22113
**Shchurov, O.A.,** *See* Bortnikov, A.V., 3:22555
**Shearer, J.W.,** *See* Damm, C.C., 3:22543
**Sheehan, D.R.,** Experiences in direct firing of glass furnaces, Columbine Glass, 3:21808 (CONF-770658—, pp 15-28)
**Sheih, C.M.,** Application of a statistical trajectory model to the simulation of sulfur pollution over northeastern United States, 3:22151
**Shekhter, V.M.,** *See* Choban, E.A., 3:22345
**Shen, Y.R.,** *See* Bischofberger, T., 3:22029
**Shenoy, G.K.,** *See* Dunlap, B.D., 3:21969
**Shepanski, J.R.,** *See* Castillo, R., 3:22657
**Sheppard, J.C.,** *See* Chen, C.K., 3:22313
**Shera, E.B.,** *See* Perry, D.G., 3:22118
**Sherby, O.D.,** Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report, 3:21556 (EPRI-NP—567)
**Sherwood, M.J.,** Environmental significance of fin erosion in Southern California demersal fishes, 3:22219
**Shestoperov, V.,** *See* Szomodyi, A., 3:22336
**Shevchenko, S.I.,** Ginzburg-Landau equations and quantum coherent phenomena in systems with electron-hole pairing, 3:22397
**Shibuya, K.,** *See* Katsuki, M., 3:21866
**Shih, D.S.,** Translation of the RNAs of brome mosaic virus: the monocistronic nature of RNA1 and RNA2, 3:22231
**Shikanov, A.S.,** *See* Zakharenkov, Yu.A., 3:22439
*See* Zorev, N.N., 3:22066
**Shimkovich, V.V.,** *See* Oboznyi, V.F., 3:21014
**Shipley, J.P.,** Decision analysis in safeguarding special nuclear material, 3:21227
**Shirakata, K.,** Measurement of anisotropy of diffusion coefficient in plate cell, 3:21626
**Shirane, G.,** *See* Hastings, J.M., 3:21914
**Shirgazin, R.G.,** *See* Khalikov, G.A., 3:20973
**Shirinov, Kh.D.,** *See* Papok, K.K., 3:20998
**Shirland, F.A.,** Thin film solar cells for terrestrial applications. Quarterly progress report no. 4, 1 April—30 June 1975, 3:21282 (PB—269671)
**Shishkin, A.A.,** *See* Nemov, V.V., 3:22471
**Shishov, Y.A.,** *See* Ageev, A.I., 3:22107, 3:22108
**Shleifer, B.M.,** *See* Reznik, V.I., 3:21495
**Shmariovich, E.M.,** Mechanism of strata infiltration ore deposition, 3:21117
**Shmukler, B.I.,** Specific features of starting operating conditions of a TGMP-324 gastight boiler of a 300 MW monoblock, 3:21493
**Shnitser, I.N.,** Combustion of anthracite in the furnace chamber of a TPP-210 boiler with drying agent feeding through the top tier of principal burners, 3:21496
**Shockley, W.E.,** *See* Shaffer, J.H., 3:21152
**Shokhudzhaev, N.,** *See* Ismailov, I., 3:22053
**Shopenberg, Z.,** *See* Szomodyi, A., 3:22336
**Shosa, D.,** *See* Kaufman, L., 3:21939
**Shpiro, G.S.,** *See* Korsakova, I.S., 3:21049
**Shreider, A.V.,** *See* D'yakov, V.G., 3:20994
**Shreve, J.D. Jr.,** Penchant for protectionism, 3:21217
**Shternberg, Z.,** *See* Prelec, K., 3:22115
**Shtromberg, B.I.,** *See* Miroshnichenko, A.M., 3:20844
**Shukeylo, I.A.,** Synchrotron acceleration of variable charge heavy ions, 3:22105 (UCRL-Trans—1541)
**Shukla, P.K.,** Intense circularly polarized waves in plasmas, 3:22513
Modulation of randomly phased whistler wave packets by kinetic Alfven and ion quasi-modes in a magnetized plasma, 3:22521
Parametric excitation of low-frequency convective cell modes by a large amplitude lower-hybrid wave in a plasma, 3:22501
*See* Spatschek, K.H., 3:22496
*See* Yu, M.Y., 3:22517
**Shvaleva, O.L.,** *See* Aksenov, L.F., 3:21335
**Sickles, J.E. II,** *See* Ripperton, L.A., 3:22147
**Sidorov, R.I.,** *See* Kochetkova, R.P., 3:21018
**Sidorova, G.A.,** *See* Sirina, T.P., 3:21844
**Siegel, R.W.,** *See* Sahu, R.P., 3:21877
*See* Tam, S.W., 3:22317
**Sigalov, Yu.M.,** *See* Umarov, G.Ya., 3:21363
**Sigl, A.B.,** *See* Corotis, R.B., 3:21461
**Silbermann, H.,** Maryland's experience in oil spill prevention and control, 3:21027
**Silin, A.V.,** *See* Abramov, Yu.I., 3:21504
**Silva, M.E.F.,** *See* Cabral, J.A.C., 3:22489
**Silver, H.F.,** *See* Schabron, J.F., 3:20893
**Simanovskii, G.P.,** *See* Deich, M.E., 3:21503

**Simon, G.D.,** *See* Schuller, C.R., 3:21423
**Simon, R.S.,** Experimental study of Yb nuclei at high angular momentum, 3:22369
**Simone, A.A.,** *See* Snell, G.J., 3:20876
**Simoyu, L.L.,** Effect of regeneration steam bleeding on economic efficiency of low-pressure steam turbine stages, 3:22087
**Simpson, G.G.,** *See* Schindler, R.E., 3:21170
**Sin'kovskaya, Z.A.,** *See* Vasilenko, G.D., 3:21011
**Sinaiskii, E.G.,** *See* Bekhman, I.M., 3:20969
**Sindelar, B.W.,** Establishment, succession, and stability of vegetation on surface mined lands in eastern Montana. Annual progress report, June 1, 1975—February 29, 1976, 3:20914 (RLO/2228/T003—2)
**Singer, J.R.,** Blood flow imaging with nuclear magnetic resonance, 3:22242
**Sinha, M.K.,** Temperature dependence of helium blistering in nickel monocrystals, 3:21896
**Sinha, S.,** *See* Caines, P.E., 3:21540
**Sinha, S.K.,** *See* Tam, S.W., 3:22317
**Sink, D.A.,** Computer code for the costing and sizing of TNS tokamaks, 3:22544 (WFPS-TME—062)
**Sinor, J.E.,** Evaluation of background data relating to new source performance standards for Lurgi gasification. Final report September 1976—February 1977, 3:20861 (PB—269557)
**Sirchis, M.,** *See* Kung, R.T.V., 3:22027
**Siren, G.,** Survival and dry matter production of some high-yield clones of SALIX and POPULUS selected for forest industry and energy production. Pilot study, 3:21259 (SHS-IFSY-RU—3)
**Sirina, T.P.,** Phase state of ash remainders of residual fuel oil, 3:21844
**Sirotin, A.M.,** *See* Surkov, Yu.V., 3:21082
**Sirotkin, L.M.,** *See* Kostyuk, V.I., 3:21016
**Sivalls, C.R.,** Glycol dehydrator design manual, 3:21077 (CONF-7603113—, pp O1-O39)
**Sivertsson, E.,** *See* Siren, G., 3:21259
**Sivinski, H.D.,** Recent developments in the Sandia Laboratories' sewage sludge irradiation program, 3:21240 (SAND—77-1411)
**Sizonenko, V.L.,** *See* Jungwirth, K., 3:22527
**Skachek, M.A.,** *See* Dement'ev, B.A., 3:21515
**Sklinzkov, G.V.,** *See* Zorev, N.N., 3:22066
**Sklizkov, G.V.,** *See* Gribkov, V.A., 3:22415
*See* Zakharenkov, Yu.A., 3:22439
**Skoda, L.F.,** Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR—77-1314)
**Skripkin, O.N.,** *See* Elkin, V.M., 3:21010
**Skripkina, P.A.,** *See* Pertrosyan, V.I., 3:21888
**Skulachenko, S.S.,** *See* Nazarenko, M.M., 3:22043
**Skwarski, D.,** *See* Tulecki, J., 3:22259
**Slade, E.C.,** *See* Bush, W.A., 3:20849
**Sladkovic, R.,** *See* Reiter, R., 3:22191
**Slansky, C.M.,** Technical Division quarterly progess report, July 1—September 30, 1977, 3:21169 (ICP—1132)
**Slansky, R.,** *See* Goldman, T., 3:22344
**Slivinsky, V.W.,** Crystal spectograph for imaging high-density targets, 3:22648 (UCRL—79787)
*See* Brooks, K.M., 3:22424
*See* Kornblum, H.N., 3:22425
**Slivkov, I.N.,** *See* Mikhailov, V.I., 3:22101
**Slotvinskii-Sidak, N.P.,** *See* Sirina, T.P., 3:21844
**Sluyters, T.,** *See* Lam, C., 3:22614
**Smetanina, V.I.,** *See* Manicyev, O.D., 3:21489
**Smirnov, A.S.,** *See* Zhilinskii, A.P., 3:22503
**Smirnov, Y.I.,** *See* Ageev, A.I., 3:22107, 3:22108
**Smirnova, L.A.,** Investigation of the effect of pressure on the composition of binary azeotropes, aromatic hydrocarbon $C_6$—isobutyl alcohol, 3:20999
**Smith, A.C. Jr.,** Formation of strong E-layers by intense electron-beam injection into preformed plasmas, 3:22406
**Smith, A.F.,** Evaluation of digitally enhanced LANDSAT data as applied to mineral and hydrocarbon exploration, 3:21100
**Smith, C.F.,** Instrumental neutron activation analyses for the NURE hydrogeochemical reconnaissance survey, 3:21920
**Smith, C.G. Jr.,** Geohydrolic studies of Gulf Coast interior salt domes, 3:22283 (Y/OWI/SUB—77/16537, pp 15p, Paper 2)
**Smith, D.L.,** Thermal responses of tokamak reactor first walls during cyclic plasma burns, 3:22577 (CONF-771029—189)
**Smith, D.R.,** *See* Clayton, E.D., 3:21215
**Smith, D.S.,** EPA activities in radioactive waste management, 3:21198
**Smith, G.R.,** *See* Morris, C.L., 3:22355
**Smith, G.S.,** Estimating unit cell volumes from powder diffraction data: the triclinic case, 3:21972
*See* Sivinski, H.D., 3:21240
**Smith, H.W.,** *See* Bostick, F.X., 3:21405
**Smith, J.E.,** Relationship of new Texas sour gas rules to gas conditioning operations, 3:21088 (CONF-7603113—, pp P1-P11)
**Smith, L.E.,** *See* Morris, C.L., 3:22355
**Smith, M.F.,** Geothermal energy. Volume 1. Search period covered: 1970—1974. Citations from the Engineering Index Data Base, 3:21390
**Smith, P.R.,** *See* Moore, R., 3:21340
**Smith, R.R.,** *See* Burrell, C.F., 3:22618
**Smyth, J.R.,** Crystal structure of synthetic proto-pyroxene $Li_{0.3}Sc_{0.3}Mg_{1.4}Si_2O_6$, 3:21455
Synthesis and crystal structure of a magnesium—lithium—scandium protopyroxene, 3:21967
**Snatzke, C.,** Heat emission of windows, exposed to the Sun, 3:21334
**Snell, G.J.,** Application of Lummus antisolvent deashing technology to a solvent refined coal solution. Final report, 3:20876 (EPRI-AF—234)
**Snihs, J.O.,** General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants, 3:22260 (ORNL-tr—4547)
**Snyder, H.D.,** *See* Kephart, R.D., 3:22334
**Soares, C.,** *See* Ehrlich, M., 3:21238
**Soatov, F.,** *See* Umarov, G.Ya., 3:21363
**Sokolov, N.I.,** *See* Bortnikov, A.V., 3:22555
**Sokolov, V.,** *See* Szomodyi, A., 3:22336
**Sokolov, Y.N.,** *See* Beloglazov, A.A., 3:21768
**Sokolov, Yu.A.,** *See* Alikaev, V.V., 3:22504
**Solberg, J.J.,** *See* Engi, D., 3:22002
**Solbes, A.,** *See* Becker, F.E., 3:21753
*See* Demirjian, A., 3:21752
**Solheim, B.A.,** *See* Prestwich, G.D., 3:21980
**Solomonov, V.I.,** *See* Bokhan, P.A., 3:22050
**Somorjai, G.A.,** *See* Muetterties, E.L., 3:21953
**Sonder, E.,** Practical reasons for investigating ion transport in high temperature insulating materials, 3:21906
**Soone, L.K.,** *See* Tager, S.A., 3:20930
**Sorkin, E.I.,** *See* Amosov, V.V., 3:21013
**Sorokin, N.A.,** *See* Marchenko, Yu.A., 3:21497
**Sorokin, P.V.,** *See* Derkach, A.Y., 3:22009
**Sorokina, B.A.,** Experimental investigation of the density of residual fuel oil of Tyumen deposit petroleum types, 3:21041
**Southworth, F.H.,** *See* Gerdin, G.A., 3:22564
*See* Miley, G.H., 3:22624
**Spackman, W.,** Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April—June 1977, 3:20889 (FE—2030-8)
**Spalding, I.J.,** *See* Donaldson, T.P., 3:22434
**Spampinato, P.T.,** Remote servicing considerations for near term tokamak power reactors (TNS). Final summary, 3:22678 (CONF-771109—84)
**Spanke, D.,** Experiences with heat pumps in heat recovery from the ground, 3:21771 (AED-Conf—1977-072-010)
**Spatschek, K.H.,** Filamentation of large amplitude lower-hybrid waves, 3:22496
*See* Shukla, P.K., 3:22513
**Spears, D.L.,** *See* Sutton, E.C., 3:22295
**Spencer, J.E.,** *See* Blanpied, G.S., 3:22354
**Spigarelli, S.A.,** *See* Beitinger, T.L., 3:22248
**Spindler, M.,** Petrochemical refinery Burghausen. Reversal and expansion of the ethylene production of the German Marathon Petroleum GmbH in Burghausen, 3:20988
**Spinka, H.,** *See* Auer, I.P., 3:22335
*See* Hidaka, H., 3:22342
**Spiridonov, Yu.G.,** Experimental determination of thermal conductivity coefficient of $UO_2$ and fuel cladding contact conduction in fuel elements under reactor irradiation, 3:21902 (NIIAR-P—250)
**Spitz, H.,** Design and application of a continuous, digital-output, environmental radon measuring instrument, 3:22176 (HASL—325, pp 48-64)
**Spong, D.A.,** Macroscopic kink instabilities in toroidal relativistic beams, 3:22491
**Sporov, E.A.,** *See* Derkach, A.Y., 3:22009
**Sprangle, P.,** Constant radius magnetic acceleration of a strong non-neutral proton ring, 3:22098
**Staats, P.A.,** *See* Barnett, C.F., 3:22419
**Stabrylla, R.G.,** Boron/aluminum fan blades for scar engines. Final report, 3:21907 (N—77-26135)
**Stacey, W.M. Jr.,** Plasma engineering studies for the tokamak experimental power reactor, 3:22535 (CONF-771029—190)
Plasma-wall-divertor model for tokamaks, 3:22588
**Stahlberg, R.,** Significance of hydraulic testing of reactor pressure vessels from the standpoint of fracture mechanics, 3:21609
**Stallard, B.W.,** *See* Damm, C.C., 3:22543
**Stalter, R.,** Preparing environmental impact statements: comments based on personal experience, 3:21548
**Stammbach, T.,** *See* Gruebler, W., 3:22338
**Stark, R.,** *See* Gerdin, G.A., 3:22564
**Stassinopoulos, E.G.,** Radiation background in space and its evaluation, 3:22291
**Statham, P.J.,** Deconvolution and background subtraction by least-squares fitting with prefiltering of spectra, 3:21943
**Stauber, M.C.,** Induced radiations in spacecraft as background to gamma/x-ray measurements, 3:22292

**Stearley, K.L.,** *See* Schultz, A.J., 3:21951
**Steele, W.F.,** *See* Burrell, C.F., 3:22618
**Stefani, D.F.,** *See* Clark, R.C. Jr., 3:22270
**Stefant, R.J.,** General dispersion relation for nonpotential ion harmonic waves propagating in plasmas with arbitrary $\beta$, 3:22507
**Steiger, A.,** Reciprocating internal combustion engine for operation with fuel in powder form, 3:21861
**Steiger, A.D.,** *See* Pexton, R.L., 3:22402
**Steinberg, M.,** Thermochemical water-splitting cycle applicable to fusion reactors for production of synthetic fuels, 3:22685
**Steiner, D.,** *See* Reid, F.L., 3:22557
*See* Shannon, T.E., 3:22572
**Steiner, E.,** *See* Daum, M., 3:22332
**Steinhauer, L.,** *See* Hoffman, A., 3:22569
**Stejskal, J.,** Recombinator of hydrogen and oxygen, 3:21177
**Stekhun, A.I.,** *See* Oblasova, L.Z., 3:21054
**Stelcer, J.,** *See* Antic, S., 3:21004
**Stelson, P.H.,** *See* McGowan, F.K., 3:22370
*See* Stokstad, R.G., 3:22356
**Stenberg, V.I.,** *See* Ralston, D., 3:20881
**Stenin, S.I.,** *See* Pertrosyan, V.I., 3:21888
**Stenzel, R.L.,** Experiments on current-driven three-dimensional ion sound turbulence. Part I: Return-current limited electron beam injection, 3:22483
Experiments on current-driven three-dimensional ion sound turbulence. Part II: Wave dynamics, 3:22484
**Stephan, H.,** Present position of electron beam melting and casting technology, 3:21837
**Stephens, F.S.,** *See* Gizon, J., 3:22362
*See* Simon, R.S., 3:22369
**Stevens, A.R.,** *See* Tyndall, R.L., 3:22228
**Stevens, H.,** *See* Brooks, J.N., 3:22676
**Stevens, H.C.,** *See* Misra, B., 3:22610
**Steverding, B.,** Early stages of light interaction with solids at extreme intensities, 3:22443
**Stewart, A.G.,** High power pulse compression techniques, 3:22606
**Stewart, H.,** *See* Salkov, H.R., 3:21727
**Stewart, R.D.,** *See* Corman, J.C., 3:21476
**Stichling, F.,** *See* Benndorf, H., 3:21534
**Sticker, H.,** *See* Akimov, Y., 3:22333
**Stickler, D.,** *See* Ubhayakar, S.K., 3:20855
**Stieglitz, L.,** *See* Schmieder, H., 3:21154
**Stillinger, F.H.,** Revised central force potentials for water, 3:22316
**Stillwagon, R.E.,** *See* Heck, F.M., 3:22605
**Stimpson, H.R.,** Burn stability in a reversed field pinch, 3:22470
**Stirling, W.L.,** Impurity studies experiment/ORMAK-upgrade neutral beam systems, 3:22626
New ORNL neutral beam transport system, 3:22615 (CONF-771029—147)
*See* Schwenterly, S.W., 3:22684
**Stocks, J.,** *See* Down, C.G., 3:21843
**Stokes, R.H.,** *See* Britt, H.C., 3:22364
**Stokstad, R.G.,** Measurements of the fusion of $^{12}C + {}^{14}N$ and the liquid-drop limit for $^{26}Al$, 3:22356
**Stolfa, F.,** Combination thermal cracking and coking process, 3:20997
**Stoll, G.J.,** Training and career plan for engineers in the nuclear industry, 3:21602
**Stomov, A.S.,** *See* Vasilenko, G.D., 3:21011
**Stone, D.S.,** Magnetic extraction of runaway electrons from a tokamak plasma, 3:22450
**Stone, J.A.,** *See* Karraker, D.G., 3:21962
**Storey, J.W.V.,** *See* Sutton, E.C., 3:22295
**Storm, E.K.,** *See* Brooks, K.M., 3:22424
*See* Manes, K.R., 3:22647
**Stowers, I.F.,** Damage history of Argus, a 4TW Nd-glass system, 3:22026 (UCRL—80419)
**Stoy, B.,** Lowering the electricity consumption of the larger domestic electric appliances, 3:21788
**Strachan, J.D.,** *See* Brusati, M., 3:22449
**Strakey, J.P.,** *See* Johnson, G.E., 3:20904
**Strand, J.B.,** *See* Rode, J.S., 3:21151
**Strand, J.R.,** *See* May, R.T., 3:21123
**Streifer, W.,** *See* Burnham, R.D., 3:22062
**Stricker, F.,** Laser induced thermonuclear fusion, 3:22659
**Stritzke, P.,** *See* Meyer, I., 3:22474
**Stroem, H.,** Air pollution cleaning needs varied approach, 3:22095
**Strydom, O.A.W.,** *See* Brown, G.M., 3:21968
**Stucky, G.D.,** *See* Schultz, A.J., 3:21935, 3:21951
**Styron, C.E.,** Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM—2497(OP))
**Subramanian, A.K.,** *See* Zaborszky, J., 3:21470
**Suchkov, A.F.,** *See* Basov, N.G., 3:22044
**Suckewer, S.,** *See* Brusati, M., 3:22449
**Sucov, E.W.,** Impurity and gas throughput control for TNS, 3:22580 (WFPS-TME—060)
**Suda, T.,** *See* Baarli, J., 3:22262
**Suenaga, M.,** *See* Dew-Hughes, D., 3:21887
**Suetsugu, Y.,** *See* Mochida, I., 3:20985
**Sugar, S.,** *See* Szomodyi, A., 3:22336
**Suggitt, R.M.,** Hydrocarbon upgrading process, 3:20986
**Sugikawa, S.,** In-line gas chromatograph for analysis of $UF_6$ and/or $F_2$, 3:21159
**Suh, P.K.,** *See* Stauber, M.C., 3:22292
**Sukharev, F.M.,** *See* Troyanovskii, B.M., 3:21611
**Sullivan, A.H.,** *See* Baarli, J., 3:22253, 3:22262
**Sullivan, J.C.,** *See* Thompson, R.C., 3:21959
**Sullivan, R.P.,** *See* Abrams, L.A., 3:21211
**Sultanov, A.S.,** *See* Vdovina, E.D., 3:21178
**Sulyaev, R.M.,** *See* Baratov, D.G., 3:22116
**Sulzberger, V.T.,** Off-peak energy storage concept for electric utilities: Part I. Electric utility requirements, 3:21521
**Sumi, K.,** Present and future status of geothermal power generation in Japan and abroad, 3:21398
**Sung, T.Y.,** *See* Kulcinski, G.L., 3:22687
**Suomi, V.E.,** *See* Schubert, G., 3:22303
**Surkov, Yu.V.,** Use of pulsation-type cooling plants for low-temperature treatment of natural gas, 3:21082
**Suter, K.,** *See* Baarli, J., 3:22262
**Sutherland, R.I.,** *See* Castillo, R., 3:22657
**Sutter, S.L.,** *See* Schwendiman, L.S., 3:22013
**Sutton, E.C.,** Spatial heterodyne interferometry of VY Canis Majoris, alpha Orionis, alpha Scorpii, and R Leonis at 11 microns, 3:22295 (N—77-27049)
**Suzukawa, H.H. Jr.,** Quasiclassical trajectory study of the energy transfer in $CO_2$—rare gas systems, 3:22319
**Suzuki, H.,** Reactions between SiC and Pd or $CeO_2$ at high temperatures, 3:21576
**Suzuki, S.,** *See* Isao, K., 3:21251
**Svechkarev, I.V.,** Magnetic properties of zinc and of cadmium alloys with magnesium and with mercury, 3:21890
**Svei, D.,** *See* Carroll, T.O., 3:21679
**Svensson, E.C.,** *See* Buyers, W.J.L., 3:21901
**Sviatoslavsky, I.N.,** *See* Abdel-Khalik, S.I., 3:22668
**Svoboda, R.,** *See* Bodmer, M., 3:21558
**Swank, J.,** OSO-8 x-ray observations of AM Hersoulis, 3:22296 (N—77-27050)
**Swansen, J.E.,** *See* Ensslin, N., 3:21230
**Swanson, C.R.,** Heber Geothermal Demonstration Plant, 3:21437
**Swartz, B.,** *See* de Boor, C., 3:22401
**Sweitser, D.,** PVC-stabilizators, 3:21911
**Swidler, J.C.,** Conservation of energy through state action, 3:21783
**Swiss, M.,** Norway's oil and gas wealth stimulates industrial growth, 3:21735
**Symonds, P.A.,** Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau, 3:22284
**Synakh, V.S.,** *See* Budneva, O.B., 3:22531
*See* Zakharov, V.E., 3:22533
**Synder, H.J. Jr.,** Federal regulatory control of oil spill removal methods, 3:21024
**Syrtlanov, R.Sh.,** Pipeline design with consideration of the possibility of using a diluent, 3:21037
**Szakasits, J.J.,** *See* Davis, C.E., 3:21034
**Szili, Z.,** *See* Saint-Hilaire, G., 3:22426
**Szomodyi, A.,** Multiple generation of particles in collisions of nuclei of energy higher than $10^{12}$ eV, 3:22336

## T

**Tabler, D.C.,** *See* Johnson, M.M., 3:22094
**Tabuchi, A.,** Some problems in radiation exposure of pregnant women, 3:22258
**Tacchi, K.J.,** *See* Bessler, D.U., 3:20996
**Tagare, S.G.,** Propagation of nonlinear electrostatic drift solitary waves in a collisionless plasma consisting of two ion species, 3:22502
**Tagawa, T.,** Piping facilities for geothermal power stations, 3:21445
**Tager, S.A.,** Investigation of the behavior of the mineral matter of acid composition in high temperature combustion of coal, 3:20930
**Tai-Pow, J.,** *See* Aitken, J.H., 3:22167, 3:22186
**Takada, A.,** Petrological approach to development of geothermal energy, 3:21441
**Takagi, H.,** *See* Hisamasu, T., 3:20908
**Takahashi, F.,** *See* Fujino, M., 3:21146
**Takahashi, K.,** *See* Takeuchi, H., 3:22412
**Takahashi, O.,** *See* Michiyoshi, I., 3:22609
**Takeshita, K.,** *See* Mochida, I., 3:20985
**Takeuchi, H.,** Ion temperature scaling on Jaeri tokamaks, 3:22412
**Talbot, J.B.,** Recovery of tritium from solid Li-Al and sintered aluminum product (SAP) blanket materials, 3:22635
**Taldykin, K.M.,** *See* Lokshin, V.A., 3:21508
**Talenskii, O.N.,** *See* Basov, N.G., 3:22051
**Talumaa, R.Yu.,** *See* Tager, S.A., 3:20930
**Talwar, S.P.,** Quest for fusion power, 3:22551
**Talyakov, E.Sh.,** *See* Mazagarov, A.M., 3:21086
**Tam, S.W.,** Theory of the temperature dependence of positron bulk lifetimes-implications for vacancy formation enthalpy measurements via positron experiments, 3:22317 (CONF-761027—26)
**Tamalet, M.,** How to decrease the energy demand of powder metallurgy furnaces, 3:21832
**Tamaye, E.E.,** *See* Bretschneider, C.L., 3:21327
**Tamura, C.,** *See* Mizusawa, S., 3:21865
**Tan, W.P.S.,** *See* Laing, E.W., 3:22464
**Tanabe, K.,** *See* Ralston, D., 3:20881
**Tanaka, S.,** Field test of mud on temperature effect, 3:21442
Low-temperature absorption equilibrium and chemisorption in the $LaNi_5$(activated)/$H_2$ system, 3:21254
*See* Arai, Y., 3:20989
**Tang, F.C.,** *See* Glass, I.I., 3:22523
**Taniguchi, H.,** $^{222}Rn$ and its daughters in buildings at Uranium City,

Saskatchewan, 3:22187 (HASL—325, pp 141-148)
**Tanis, S.P.,** *See* Prestwich, G.D., 3:21980
**Tanner, T.M.,** *See* Wehner, A.P., 3:22277
**Tansamrit, S.,** *See* Mei, H., 3:21355
**Tarakanov, N.M.,** *See* Afonin, A.G., 3:22117
**Tardieu, A.,** Structure of human serum lipoproteins in solution. II. Small-angle x-ray scattering study of $HDL_3$ and LDL, 3:22232
**Tatarenko, V.M.,** *See* Afonin, A.G., 3:22117
*See* Baratov, D.G., 3:22116
**Taylor, N.F.,** Prediction of reserves and production performance by simulation: Halibut Feld, 3:20980
**Tazhiev, E.I.,** *See* Lyudomirskii, B.N., 3:21498
**Tegeback, R.,** Test charge problem in the theory of bounded plasmas, 3:22467
**Teichler, H.,** *See* Seeger, A., 3:22392
**Tejwani, G.D.T.,** Pressure-broadened linewidths of hydrogen sulfide, 3:21971
**Telyakov, E.Sh.,** *See* Sergeev, A.D., 3:20992
**Temirbaev, D.Zh.,** Investigation of slghtly nonisothermal models of recirculation of gases into the top part of furnace chambers of high-capacity boilers, 3:21494
**Templain, C.J.,** *See* Wilbert, W.P., 3:21121
**Templeton, D.H.,** *See* Reynolds, J.G., 3:21995
**Templeton, J.L.,** Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn—Teller distortion, 3:21952
**Tennery, V.J.,** *See* Wei, G.C, 3:21241
**Tenney, D.R.,** *See* Kennedy, J.M., 3:21908
**Teofilo, V.L.,** *See* Conn, R.W., 3:22560
**Teplyakov, D.I.,** Tower-type solar power plant: configuration and thermal-regime stability of receivers and steam generators, 3:21322
**Teraube, R.,** *See* Dutray, G., 3:21512
**Ternopol, A.M.,** *See* El-Khalafawy, T.A., 3:22514
**Tewari, D.P.,** Spatial growth of filamentation instability in a collisionless magnetoplasma, 3:22493
**Thacher, P.D.,** Refractive index and surface layers of ceramic $(Pb,La)(Zr,Ti)O_3$ compounds, 3:21904
**Theofanous, T.G.,** Nuclear reactor safety education at Purdue, 3:21668
**Thiess, P.,** *See* Battist, L., 3:22122
**Thiessen, H.A.,** *See* Blanpied, G.S., 3:22354
*See* Morris, C.L., 3:22355
*See* Perry, D.G., 3:22118
**Thomas, A.,** *See* Roux, F., 3:21567
**Thomas, G.J.,** Microstructure of high-dose multiple energy $He^+$ implanted stainless steel, 3:21899
**Thomas, J.W.,** Environmental radon and thoron monitor, 3:22169 (HASL—325, pp 22-24)
**Thomas, R.J.,** *See* Kastner, S.O., 3:22299
**Thomassen, K.I.,** *See* Hagenson, R.L., 3:22567
**Thommes, M.M.,** *See* Beitinger, T.L., 3:22248
**Thompson, C.R.,** Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL—13782)
**Thompson, D.L.,** *See* Suzukawa, H.H. Jr., 3:22319
**Thompson, R.C.,** Reaction of fluorine and hypofluorous acid with some substitution-inert complex ions in aqueous perchloric acid solutions, 3:21959
**Thompson, S.,** *See* Buck, J.V., 3:21415
**Thompson, S.L.,** *See* Freeman, J.R., 3:22599
**Thomsen, C.L.,** First year's operation: residential solar retrofit, 3:21339
**Thomson, J.J.,** *See* Max, C.E., 3:22458
**Thorne, J.G.M.,** Cutting fuel costs, 3:21779
Fluidize to maximize, 3:22086
Pollution control by incineration, 3:21850
**Tibbetts, A.M.,** Training a cleanup response team, 3:21028
**Tiee, J.J.,** Isotopically selective ir photodissociation of $SeF_6$, 3:21974
Optically pumped molecular lasers in the 11—17-μm region, 3:22035
**Tiffany, W.,** *See* Toepfer, A.J., 3:22640
**Tikhonruk, I.F.,** *See* Vasilenko, G.D., 3:21011
**Timoshek, V.E.,** *See* Amosov, V.V., 3:21013
**Ting, F.T.C.,** *See* Renton, J.J., 3:20891
**Tinsley, J.T.,** *See* Eden, A., 3:21356
**Tirsell, K.G.,** Filtered detector arrays for single pulsed photon measurements above 100 keV, 3:22653 (UCRL—80314)
High energy electron spectra from 1.06 μm laser produced plasmas, 3:22654 (UCRL—80322(Summ.))
**Titov, I.P.,** *See* Amosov, V.V., 3:21013
**Tkachenko, V.K.,** Strength of an ideal vortex lattice in a superconductor, 3:22398
**Todd, A.M.M.,** *See* Stacey, W.M. Jr., 3:22535
**Todreas, N.,** *See* Idsinga, W., 3:21559
**Toepfer, A.J.,** Stability of multiple shell ICF capsules, 3:22640 (SAND—77-1495C)
**Toeroek, G.,** Production and properties of antimony(V) aquoxide for the separation of natrium in activation analysis, 3:21973 (IS-Trans—97)
**Tomasko, M.,** *See* Knollenberg, R.G., 3:22305
**Tomica, H.,** Design, erection, maintenance and operation of helium compressors for the Thorium High Temperature Reactor at Schmehausen, 3:21575
**Toms, R.,** Oil pollution of inland waters in England and Wales, 3:21023
**Toms, R.S.H.,** Status of ERDA geothermal program and recent developments, 3:21389
**Tong, Y.M.,** *See* Kiselewich, S.J., 3:21806
**Toonkel, L.,** *See* Leifer, R., 3:22153, 3:22156
**Toonkel, L.E.,** EML Surface Air Sampling Program: the quality of analysis, 1976, 3:22154 (EML—334, pp I.37-I.67)
*See* Feely, H.W., 3:22159
*See* Leifer, R., 3:22157
**Townes, C.H.,** *See* Sutton, E.C., 3:22295
**Townsend, J.M.,** *See* Haycocks, C., 3:20916
**Travis, L.,** *See* Schubert, G., 3:22303
**Travis, M.L.,** Clinch River Breeder Reactor Plant. Internal/external cladding degradation, 3:21581 (CRBRP-ARD—0147)
**Treasure, T.,** Central ore dressing plant possible as Karoo uranium prospecting builds up, 3:21126
State may assist in making small Karoo uranium deposits viable, 3:21127
**Treibalova, Z.V.,** *See* Ageev, A.I., 3:22108
**Tret'yakova, C.,** *See* Szomodyi, A., 3:22336
**Treventi, P.A.,** One-Third-Scale Air—Water Pump Program, alternate analytical pump performance data, 3:21638 (EPRI-NP—385(Vol.1))
**Tricot, R.,** *See* Seraphin, L., 3:21568
**Tridot, G.,** *See* Boivin, J.C., 3:21900
**Trigolos, G.S.,** *See* Rabinovich, A.V., 3:21502
**Trilling, G.H.,** *See* Hauptman, J.M., 3:22337
**Triplett, M.B.,** Simulation of the nuclear power economy, 3:21703
**Trombka, J.I.,** *See* Dyer, C.S., 3:22293
*See* Yin, L.I., 3:22131
**Troshkin, S.V.,** *See* Borisov, B.N., 3:22049
**Troyanovskii, B.M.,** Experience of operation of saturated steam turbines of nuclear power plants, 3:21611
**Truelove, J.S.,** *See* Khalil, E.E., 3:22089
**Truhlar, D.G.,** Direct calculation of the equilibrium value of the energy of activation for dissociation of $H_3$ by Ar and evidence for the important contribution of collisional dissociation from low vibrational quantum numbers and high rotational quantum numbers at shock tube temperatures, 3:21954
**Truong, H.V.,** *See* Villanueva, J., 3:21375
**Truscello, V.C.,** *See* Campbell, R.W., 3:22128
**Trushin, V.S.,** Energy estimates of nonequilibrium ionization using external sources in MHD generator channel, 3:21767
**Tsai, C.C.,** *See* Schwenterly, S.W., 3:22684
*See* Stirling, W.L., 3:22615, 3:22626
**Tsang, T.W.E.,** Low temperature heat capacity of scandium and alloys of scandium, 3:21882 (IS-T—780)
**Tsarik, L.Ya.,** *See* Amosov, V.V., 3:21013
**Tsirul'nikov, L.M.,** *See* Ernest, A.K., 3:21468
**Tsivinsky, A.I.,** *See* Castillo, R., 3:22657
**Tsuji, M.,** *See* Nakamura, A., 3:21444
**Tsujino, T.,** *See* Sugikawa, S., 3:21159
**Tsukisima, T.,** *See* Iguchi, H., 3:22407
**Tsuru, S.,** *See* Isao, K., 3:21251
**Tsvetkov, M.Yu.,** *See* Zorev, N.N., 3:22066
**Tsvineva, G.P.,** *See* Ageev, A.I., 3:22107
**Tsykanov, V.A.,** *See* Spiridonov, Yu.G., 3:21902
**Tugunov, P.I.,** *See* Syrtlanov, R.Sh., 3:21037
**Tulecki, J.,** Search for radioprotective agents. Part XXXIX. Synethesis of some sulfenamides, 3:22259
**Turevskii, E.N.,** Selection of location for removal of heat of absorption in a tower, 3:20995
**Turner, H.J.,** Displacement measurements at high temperatures with capacitive transducers, 3:21577
**Turner, L.,** *See* Brooks, J.N., 3:22676
**Turner, L.R.,** Limits on the field of ohmic heating solenoids, applied to a tokamak TNS, 3:22595 (CONF-771029—199)
**Tushabramishvili, K.Z.,** *See* Baratov, D.G., 3:22116
**Tyndall, R.L.,** Isolation of pathogenic Naegleria from artificially heated waters, 3:22228 (CONF-770961—3)
**Tzach, D.,** *See* Roberson, C.W., 3:22405

## U

**Ubhayakar, S.,** *See* Becker, F.E., 3:21753
*See* Demirjian, A., 3:21752
**Ubhayakar, S.K.,** Development program for MHD power generation: coal devolatilization. Final report, Volume VI, July 1, 1975—September 30, 1976, 3:20855 (FE—2015-20)
**Uckan, N.A.,** Design features of the ELMO Bumpy Torus Reactor (EBTR), 3:22537 (CONF-771109—65)
*See* Dandl, R.A., 3:22536, 3:22563
*See* Peng, Y-K.M., 3:22561
**Udovenko, I.A.,** *See* Kostyuk, V.I., 3:21016
**Ueno, K.,** *See* Kephart, R.D., 3:22334
**Uhm, H.,** *See* Davidson, R.C., 3:22480
**Ullrich, H.,** Processing of coke furnace gas. Separation of naphthalene, 3:20886
**Ulmer, G.,** Energy profile and reduction of specific energy consumption in foundries, 3:21833

**Ulrich, G.D.,** Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977—July 31, 1977, 3:20901 (FE—2205-8)
**Umarov, G.Ya.,** Development and testing of solar water-heated boilers fabricated by diffusion welding, 3:21363
**Underhill, G.,** Recent developments in geothermal energy, 3:21438
**Underwood, D.,** *See* Auer, I.P., 3:22335
*See* Hidaka, H., 3:22342
**Une, K.,** Stress corrosion cracking of Zircaloy-2 cladding in iodine vapor, 3:21616
**Ungemach, S.R.,** Chemical applications of molecular quantum theory, 3:21947 (LBL—6699)
*See* Mahan, B.H., 3:22321
**Unger, M.K.,** *See* Tager, S.A., 3:20930
**Unger, W.E.,** Advanced fuel recycle program progress report, July 1—September 30, 1977, 3:21153 (ORNL/TM—6092)
**Untermyer, S.,** Measuring low concentrations of plutonium and americium in earth samples, 3:22202
**Urov, K.E.,** Thermal decomposition of kuckersite shale in vacuum, 3:21107
**Usanov, V.V.,** *See* Pletnev, G.P., 3:21509
**Usenko, A.S.,** *See* Tegeback, R., 3:22467
**Ushakov, V.I.,** Design of automatic condensate extractors, 3:21084
Shape of cross section of condensate film in pipes with two-phase flow, 3:21036

## V

**Vager, Z.,** *See* Gemmell, D.S., 3:22311
**Vakhidov, A.T.,** Investigation of solar absorption cooler for round-the-clock operation, 3:21366
**Valentine, J.H.,** *See* Schindler, R.E., 3:21170
**Valiknac, T.J.,** *See* Johnson, G.E., 3:20904
**Van Bilderbeek, B.H.,** Early subsea production system, 3:20981
**van Stralen, S.J.D.,** *See* Moalem, D., 3:22071
**VanArsdall, R.T.,** Agriculture and energy use in the year 2000: discussion of technological changes, 3:21716
**Vandenbosch, R.,** Spontaneously fissioning isomers, 3:22375
**Vander Sluis, K.,** *See* Barnett, C.F., 3:22419
**Vandevender, W.H.,** *See* Pickard, P.S., 3:22385
**Vanhemmen, J.J.,** Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457, 3:22224 (N—77-26934)
**Vanhoek, L.P.,** *See* Vanhemmen, J.J., 3:22224
**Vanuxem, J.P.,** Micro-NOVAC: an intelligent CAMAC controller based on a micro-NOVA computer, 3:22078 (LA—6985)
**Varaiya, P.,** *See* Athans, M., 3:21539
**Varandas, C.A.F.,** *See* Cabral, J.A.C., 3:22489
**Varghese, P.,** *See* Blanpied, G.S., 3:22354
**Varley, R.L.,** Long time behavior of the velocity autocorrelation function in a plasma, 3:22461
**Varnado, S.G.,** *See* Mitchener, J.L., 3:22662
**Vasil'ev, B.I.,** High-power pulse $NH_3$ laser pumped optically by $CO_2$ laser radiation, 3:22048
**Vasil'ev, L.A.,** *See* Borisov, B.N., 3:22049
**Vasil'ev, V.V.,** *See* Baratov, D.G., 3:22110
**Vasilenko, G.D.,** Treatment of wastewaters from succinimide additive production unit at Perm' Petroleum Refinery, 3:21011
**Vasin, O.I.,** *See* Pertrosyan, V.I., 3:21888
**Vassal, J.,** *See* Cadiou, L., 3:21564
**Vastola, F.J.,** *See* Spackman, W., 3:20889
**Vaswani, A.,** *See* Cohn, S.H., 3:22244
**Vavilin, A.N.,** *See* Shmukler, B.I., 3:21493
**Vdovina, E.D.,** Use of natural Uzbekistan zeolites for purification of low-level liquid waste. I. Sorption of radioactive cesium, 3:21178
**Vendil, D.,** Methanol as an automotive fuel, 3:21869
**Verbovetskii, E.Kh.,** *See* Babii, V.I., 3:21527
**Verdeyen, J.T.,** *See* Kaye, R.J., 3:22617
**Verhelst, W.F.,** Antistatic resp. conducting polymers filled with carbon black, 3:22006
**Verkerk, B.,** Radiation effects on salt relevant to nuclear waste disposal in salt deposits, 3:21173
**Vetter, A.A.,** *See* Nerheim, N.M., 3:22034
**Vieth, J.,** *See* Brodda, B.G., 3:21156
**Vigdorchik, A.G.,** On certain patterns in the development of the energy balance of the USSR, 3:21722
**Vilkov, G.I.,** *See* Kostyuk, V.I., 3:21016
**Villanueva, J.,** Compound trapezoidal collector (an optimized stationary concentrator), 3:21375
**Viron, I.Ya.,** *See* Aksenov, L.F., 3:21335
**Vishnevetskii, M.G.,** *See* Kosyak, Yu.F., 3:21490
**Visky, T.,** *See* Szomodyi, A., 3:22336
**Vithal, K.L.,** Electromagnetic instabilities in an anisotropic loss-cone plasma, 3:22499
**Vizcaino, H.P.,** Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX—78(77))
**Vlasov, A.D.,** Increase of the beam radius and particle oscillations due to errors in proton linear accelerators, 3:22106 (LA-tr—77-89)
**Vogel, R.M.,** *See* Medina, L.C., 3:22281
**Voitik, M.G.,** Kinetics of stimulated emission of excimer radiation from inert gases in a nonself-sustained electric discharge, 3:22042
**Voitsekhovskii, A.V.,** *See* Brudnyi, V.N., 3:21897
**Volborth, A.,** Fast-neutron activation analysis in coal research, 3:21921
Material balance in coal. 2. Oxygen determination and stoichiometry of 33 coals, 3:20888 (COO—2898-10)
**Volkov, L.A.,** *See* Deberdeev, I.Kh., 3:20921
**Volkov, V.Y.,** *See* Ageev, A.I., 3:22107
**Volkovyskii, E.V.,** *See* Ageev, A.I., 3:22107
**Vorob'ev, H.S.,** *See* Bryukhnevich, G.I., 3:22431
**Vorob'eva, V.N.,** *See* Zaitsev, V.A., 3:20993
**Vovenko, A.S.,** *See* Baratov, D.G., 3:22116
**Vredevoe, D.L.,** *See* Hays, E.F., 3:22245

## W

**Wade, C.,** *See* Kastner, S.O., 3:22299
**Wadt, W.R.,** Electronic states of $Ar^+_2$, $Kr^+_2$, $Xe^+_2$. I. Potential curves with and without spin—orbit coupling, 3:22308
**Wageman, W.E.,** *See* Alei, M. Jr., 3:22309
**Wagner, H.F.,** *See* Schmidt-Kuester, W.J., 3:21720
**Wagner, S.C.,** State taxation of geothermal resources compared with state taxation of other energy minerals, 3:21431
**Wahl, H.,** *See* Kephart, R.D., 3:22334
**Waide, C.H.,** *See* Hoffman, K.C., 3:21255
**Waite, D.A.,** *See* Moeller, D.W., 3:21202
**Wakabayashi, J.,** *See* Ohnishi, M., 3:22587
**Wakita, K.,** *See* Yora, M., 3:21402
**Walker, B.V.,** *See* Judd, B.T., 3:21868
**Walker, G.,** *See* Clayton, E.D., 3:21215
**Walker, J.D.,** Microbial petroleum degradation: the role of cladosporium resinae, 3:22274 (CONF-730386—, pp 821-825)
**Walker, M.S.,** Fast ramp superconductor for ohmic heating coils, 3:22592 (CONF-771029—180)
*See* Schindler, R.E., 3:21170
**Walker, P.E.,** *See* Blink, J.A., 3:22675
**Walker, P.L.,** *See* Spackman, W., 3:20889
**Wallach, S.,** *See* Cohn, S.H., 3:22244
**Walter, F.,** Geophysical well logging for geohydrological purposes in unconsolidated formations, 3:22282 (N—77-26598)
**Walters, W.B.,** *See* Glascock, M.D., 3:22363
**Walton, J.D. Jr.,** Georgia Tech Solar Thermal Test Facility, 3:21317
**Wang, L.S.,** *See* Wang, M.Y., 3:22417
**Wang, M.Y.,** Alpha particle effects on the reversal field mirror, 3:22417
**Wang, S.T.,** ANL experimental program for pulsed superconducting coils, 3:22593 (CONF-771029—184)
**Ward, P.L.,** Sandia/USGS magma workshop, 3:21401
**Ward, R.L.,** *See* Sivinski, H.D., 3:21240
**Ware, S.A.,** Single cell protein and other food recovery technologies from waste. Final report March—September 1976, 3:21841 (PB—270085)
**Warnecke, E.,** *See* Poetzschke, M., 3:21161
**Warner, J.S.,** Determination of sulfur-containing petroleum components in marine samples, 3:21051
**Warris, B.J.,** *See* Nyein, R.K., 3:20978
**Warshaw, S.I.,** LEG System: a general Lagrangian-to-Eulerian hydrodynamic code linkage, 3:22323 (UCID—17680)
**Washington, C.E.,** *See* Chuang, A.S., 3:21583
**Wasielewski, M.R.,** *See* Katz, J.J., 3:21308
**Watanabe, K.,** *See* Yora, M., 3:21402
**Watanabe, Y.,** *See* Auer, I.P., 3:22335
*See* Hidaka, H., 3:22342
**Waters, E.M.,** Trichloroethylene. I. An overview, 3:21984
**Watkins, R.A.,** Safety Analysis Report for Packaging (SARP): USA/9507/BLF (ERDA—AL), Model AL-M1, 3:22012 (MLM—2447)
**Watson, I.,** Measurement techniques for AGR circulators in a full-density rig, 3:21661
**Watt, R.D.,** *See* Ballam, J., 3:22126
**Watts, H.L.,** *See* Uckan, N.A., 3:22537
**Waynert, J.A.,** Comparative study of electron—phonon interaction in three vanadium samples of varying purity. Interim report1 October 1973—30 September 1975, 3:21880 (AD-A—042702)
**Weaver, R.,** Interstellar bubbles. II. Structure and evolution, 3:22301
**Webb, W.E. Jr.,** Feasibility of transporting nuclear fuel by air, 3:21163
**Weber, E.C.,** *See* Silbermann, H., 3:21027
**Webster, R.K.,** *See* McKay, H.A.C., 3:21155
**Weggel, C.,** *See* Cohn, D.R., 3:22600
**Wehner, A.P.,** Pulmonary deposition, translocation and clearance of inhaled neutron-activated talc in hamsters, 3:22277
**Wei, G.C,** Assessment of fibrous insulation materials for the selenide isotope generator system, 3:21241 (ORNL/TM—5908)

**Weiss, B.,** *See* Tardieu, A., 3:22232
**Weissman, J.C.,** *See* Benemann, J.R., 3:21311
**Weisz, M.,** Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
**Weitz, P.G.,** Calorific value determination of liquefied hydrocarbon gases by capacity measuring, 3:21098
**Weitz, P.G. Jr.,** Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring, 3:21097
**Weldon, W.F.,** TEXT Energy Storage System, 3:22604 (ORO—5594-9)
**West, E.D.,** System for calibrating laser power meters for the range 5-1000 W, 3:22023 (PB—269777)
**West, G.A.,** Deactivation of vibrationally excited ozone by $O(^3P)$ atoms, 3:22322
**Weston, R.E. Jr.,** *See* Preses, J.M., 3:21989
*See* West, G.A., 3:22322
**Weth, G.,** *See* Brooks, R.D., 3:21482
**Whebell, B.,** *See* Kahlert, G., 3:21842
**Wheelock, T.D.,** *See* Pulsifer, A.H., 3:20864
**Whiffen, J.D.,** *See* Ratner, B.D., 3:22250
**White, C.W.,** *See* Young, R.T., 3:21912
**White, J.M.,** Experimental Auger electron spectrum of ammonia, 3:21966
**White, J.R.,** Posttest REALP4 analysis of LOFT experiment L1-3A, 3:21646 (TREE-NUREG—1137)
**Whitman, A.M.,** *See* Cohen, I.M., 3:21529
**Whittemore, A.R.,** *See* Menasian, S.C., 3:22437
**Whitten, C.A. Jr.,** *See* Blanpied, G.S., 3:22354
**Wickland, C.E.,** Summary report of soil removal preliminary excavations. (Report No. ES-389-75-171), 3:21166 (RFP—2458)
**Wienke, B.R.,** Hydrogen transport in a two-dimensional torodial plasma, 3:22469
**Wiesepape, C.F.,** Experimental equilibrium ratios of a Devonian crude—natural gas system, 3:21039 (CONF-770375—, pp 18-25)
**Wiffen, F.W.,** *See* Talbot, J.B., 3:22635
**Wiggins, P.F.,** *See* Duffey, D., 3:21924
**Wijatno, H.,** Aluminum recovery from coal fly ash by high temperature chlorination, 3:20903 (IS-T—777)
**Wilberg, R.,** *See* Bollinger, H., 3:21876
**Wilbert, W.P.,** Preliminary study of uranium favorability of the Wilcox and Claiborne Groups (Eocene) in Texas, 3:21121 (GJBX—7(78))
**Wilhelmi, B.,** *See* Schmutzer, E., 3:22463
**Wilhelmsson, H.,** *See* Pavlenko, V.P., 3:22492
**Wilke, D.A.,** Solar powered anaerobic wastewater treatment plant, 3:21361
**Wilkening, M.,** Radon levels and ventilation effects in underground enclosures, 3:22184 (HASL—325, pp 110-113)
**Wilkerson, A.W.,** Waste energy source utilization circuit and method, 3:21517
**Wilkerson, C.L.,** *See* Wehner, A.P., 3:22277
**Willaert, E.,** *See* Tyndall, R.L., 3:22228
**Willen, E.H.,** Tables of particle fluxes, 3:22120 (BNL—23493)
**Williams, C.T.,** Analysis of the production performance of the Windalia Sand Reservoir of the Barrow Island Oil Field, 3:20979
**Williams, D.L.,** *See* Lewellen, T.K., 3:22123
**Williams, J.E.C.,** Superconducting magnetohydrodynamics magnet development program: Phase I. Quarterly technical progress report No. 3 (Revision A), November 1, 1976—January 31, 1977, 3:21759 (FE—2295-1)
*See* Cohn, D.R., 3:22600
**Williams, J.M.,** Progress in fusion technology, 3:22571
*See* Maffly, R.L., 3:21970
*See* Schultz, A.J., 3:21935, 3:21951
**Williams, J.R.,** Design and installation of the HUD solar home in Shenandoah, Georgia, 3:21346
Development of a total energy system for the Cedar Gap Christian Retreat Center, 3:21707
*See* Debs, A.S., 3:21344
*See* Hudson, W.T., 3:21345, 3:21350
*See* Leonaitis, L.L., 3:21351
*See* Lindsay, W., 3:21347
*See* McCloud, W.T. II, 3:21348
*See* Reihl, J.D., 3:21349
**Williams, R.L.,** Reliability engineering, why do we need it, 3:21614
**Williams, R.M.,** Uranium, 3:21134
Uranium supply to 2000, Canada and the world, 3:21164 (MR—168)
**Wilson, D.D.,** *See* de Mello, R.W., 3:22549
**Wilson, K.L.,** *See* Thomas, G.J., 3:21899
**Wilson, N.H.M.,** Second generation computer control procedures for dial-a-ride, 3:21805
**Wilson, R.R.,** *See* Watson, I., 3:21661
**Winkler, K.,** Magnetic tuning system for dye lasers, 3:22040
**Winks, R.W.,** One-Third-Scale Air—Water Pump Program: test program and pump performance, 3:21637 (EPRI-NP—135)
**Winsche, W.E.,** *See* Hoffman, K.C., 3:21255
**Wirth, G.,** Method to recover uranium from uranium-containing phosphate ores, 3:21138
**Wiser, W.H.,** *See* Hill, A.H., 3:20882
*See* Lytle, J.M., 3:20848
**Wiswall, R.H.,** *See* Hoffman, K.C., 3:21255
**Witherspoon, J.P.,** Releases of radioactivity from uranium mills and radwaste effluent costs, 3:21206
**Wittig, C.,** *See* Tiee, J.J., 3:21974, 3:22035
**Woerner, R.L.,** Fabrication of cryogenic laser fusion targets, 3:21236 (UCRL—79442)
**Wolf, M.,** Near-term prospectives for photovoltaic solar energy conversion, 3:21299
**Wolfer, W.G.,** *See* Abdel-Khalik, S.I., 3:22668
**Wolfsberg, M.,** *See* Suzukawa, H.H. Jr., 3:22319
**Wollenberg, H.,** *See* Bowman, H., 3:21412
**Woltermann, H.A.,** *See* Seabaugh, P.W., 3:21232
**Wong, A.Y.,** SURMAC: an advanced fuel fusion reactor, 3:22565
**Wonn, J.W.,** *See* Bartko, J., 3:21933
**Woo, W.,** Ponderomotive force and dc magnetic field generation induced by laser absorption, 3:22509
**Wood, B.E.,** *See* Grimmer, D.P., 3:21378
**Wood, R.E.,** *See* Hill, A.H., 3:20882
*See* Lytle, J.M., 3:20848
**Wood, W.B.,** *See* Reid, F.L., 3:22557
**Wood, W.W.,** Goals and projects of U.S. Geological Survey for the study of solid low-level radioactive wastes, 3:21199
**Woodall, D.M.,** Use of advanced fuels in pellet implosion reactor engineering, 3:22672
**Wooding, E.R.,** *See* Shamim, A., 3:22430
**Woodruff, G.L.,** *See* Eccleston, G.W., 3:22379
**Woods, C.M.,** Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976—30 September 1977, 3:20879 (IS—4310)
Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April—30 June 1977, 3:20880 (IS—4311)
**Woodson, H.H.,** *See* Weldon, W.F., 3:22604
**Woolhouse, G.R.,** *See* Monemar, B.A., 3:22058
**Woolsey, N.F.,** *See* Ralston, D., 3:20881
**Worley, N.G.,** Nuclear reactors and hydrogen production, 3:21246
**Wrenn, M.E.,** *See* Spitz, H., 3:22176
**Wright, R.J.,** Resistive instability of a low-beta plasma cylinder without assumed mode localization, 3:22497
**Wu, C.T.,** Fabrication and properties of high-temperature weak links and SQUID's, 3:22008
**Wulff, H.,** Buchloe indoor swimming pool as an example of energy saving and environmentally beneficial system solution, 3:21776
**Wurzbacher, G.,** Gasification as a first step to using coal as a fuel and raw material, 3:20868
**Wyatt, W.B. Jr.,** Thermally insulated panel, 3:21774

## Y

**Yaakobi, B.,** Spatial resolution of laser produced plasmas with x-ray crystals, 3:22440
**Yablokov, L.D.,** *See* Samoilovich, G.S., 3:21505
**Yakimenko, I.P.,** *See* Tegeback, R., 3:22467
**Yakovlev, E.I.,** *See* Ionin, D.A., 3:21095
**Yakutseni, V.P.,** Influence of hydrate formation on the information content of indicators of oil-bearing and gas-bearing potential, 3:20941
**Yamada, R.,** *See* Akimov, Y., 3:22333
**Yamaguchi, A.,** Uranium refining process using ion exchange membrane, 3:21139
**Yamaguchi, K.,** CdS-CdTe solar cell prepared by vapor phase epitaxy, 3:21286
**Yamamoto, S.,** *See* Nishihara, H., 3:21147
**Yamanaka, C.,** *See* Mochizuki, T., 3:22315
**Yamashita, M.,** Laser isotope separation, 3:21143
**Yamazaki, T.,** Circular polarization of muonic x rays and origin of strange $\mu^-$ depolarization in Pd metal, 3:22318
**Yampol'skii, N.G.,** *See* Kostyuk, V.I., 3:21016
**Yanagihara, H.,** *See* Mizusawa, S., 3:21865
**Yang, C.S.,** *See* Pigford, T.H., 3:21233
**Yang, D.J.,** Kinetic study of the hydrolysis of 2-germaacetate in neutral and alkaline solutions, 3:21958
**Yano, K.,** *See* Tabuchi, A., 3:22258
**Yarborough, K.A.,** Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves, 3:22185 (HASL—325, pp 114-128)
**Yarlagadda, B.S.,** *See* Herzenberg, C.L., 3:20887
**Yarosh, V.V.,** *See* Pan, V.M., 3:21913
**Yastrebov, M.T.,** Natural radioactivity of some soils in landscapes of the kolochnaya forest-steppe of the Tambov region, 3:22203 (ORNL-tr—4518)
**Ybarrondo, L.J.,** *See* Leach, L.P., 3:21652
**Yeater, M.L.,** Course in quality assurance, nondestructive testing, and nuclear standards, 3:21608
**Yeh, H.T.,** *See* Uckan, N.A., 3:22537
**Yen, T.F.,** *See* Schwager, I., 3:20895
**Yeung, E.S.,** *See* Tejwani, G.D.T., 3:21971
**Yin, L.I.,** Portable low-dose x-ray imaging system, 3:22131
**Yoh, J.K.,** *See* Kephart, R.D., 3:22334
**Yokosawa, A.,** *See* Auer, I.P., 3:22335
*See* Hidaka, H., 3:22342
**Yokoyama, S.,** Average number of generations until extinction and rate of

allelism of lethal genes in a subdivided population, 3:22239 (RLO/2225/T5—35)
**Yora, M.**, Geothermal system of the northern Hachimantai area, 3:21402
**Yoshida, T.**, *See* Mochida, I., 3:20985
**Young, J.R.**, *See* Conn, R.W., 3:22560
**Young, L.L.**, Solar energy research at Sandia Laboratories with unique health and safety parameters, 3:21271 (SAND—77-1412C)
**Young, R.E.**, *See* Schubert, G., 3:22303
**Young, R.T.**, Laser annealing of boron-implanted silicon, 3:21912
**Youngdahl, C.K.**, First wall stress analysis for a Tokamak reactor, 3:22584
*See* Misra, B., 3:22610
**Yousif, A.N.**, Rapid simultaneous determination of sulfur and vanadium in crude oil using X-ray fluorescence, 3:21932
**Youssef, A.M.**, *See* El-Khalafawy, T.A., 3:22514
**Yu, M.Y.**, Formation of upper-hybrid solitons, 3:22517
Solitary electrostatic ion cyclotron waves, 3:22522
*See* Shukla, P.K., 3:22501, 3:22513
*See* Spatschek, K.H., 3:22496
**Yu, S.K.W.**, Methods and correlations for the prediction of quenching rates on hot surfaces, 3:21615
**Yu, W.S.**, Redundant coolant capability for fusion reactor blankets, 3:22612
**Yudin, I.I.**, *See* Nazarenko, M.M., 3:22043
**Yudow, B.**, Feasibility study of transporting offshore OTEC-produced energy to shore by thermal media. Project 8980 third topical report, November 1976—July 1977, 3:21326 (DSE/2426—19)
**Yuferov, V.B.**, *See* Derkach, A.Y., 3:22009
**Yuko, M.J.**, *See* Reid, R.L., 3:21379
**Yung, D.**, *See* Goldstein, D.J., 3:20913
**Yur'ev, L.V.**, *See* Shnitser, I.N., 3:21496
**Yurchenko, E.I.**, *See* Pogutse, O.P., 3:22488
**Yurin, E.M.**, *See* Grigor'ev, E.I., 3:21301
**Yust, C.S.**, *See* Pollmann, E., 3:21145

## Z

**Zablocki, C.J.**, *See* Anderson, L.A., 3:21406
**Zaborszky, J.**, Control interfaces of generation allocation of the large interconnected power system, 3:21470
**Zabransky, B.J.**, *See* Gemmell, D.S., 3:22311
**Zagorodny, A.G.**, *See* Tegeback, R., 3:22467
**Zagoruchenko, V.A.**, Generalized equation of state of liquid n-alkanes, 3:21044
**Zahn, H.**, Mass spectroscopic determination of plasma parameters in laser microplasmas of solids and their mathematical relationships, 3:22442 (IS-Trans—99)
**Zaitsev, M.M.**, *See* Baratov, D.G., 3:22109
**Zaitsev, V.A.**, Aerodynamic method for monitoring particle size distribution of microbead catalysts, 3:20993
**Zaitsev, V.M.**, *See* Grigor'ev, E.I., 3:21301
**Zakharenkov, Yu.A.**, Investigation of perturbation of a laser plasma density profile by the high-speed interferometry method, 3:22439
**Zakharov, V.E.**, Dynamics of collapse of Langmuir waves in hot plasma, 3:22533
*See* Budneva, O.B., 3:22531
**Zakharov, Yu.V.**, *See* Shapiro, G.A., 3:21510
**Zakhidov, R.A.**, Analyzing multifacet concentrating systems, 3:21374
**Zalkin, A.**, *See* Reynolds, J.G., 3:21995
**Zamulinskii, I.M.**, Distribution of nitrogen in the refining products of some types of petroleum of the subcarpathian region, 3:21043
**Zandt, G.**, *See* Chouet, B., 3:21407
**Zanzi, I.**, *See* Cohn, S.H., 3:22244
**Zaraiskii, S.I.**, *See* Reznik, V.I., 3:21495
**Zaripov, V.K.**, *See* Semena, M.G., 3:22005
**Zavertailo, M.M.**, *See* Shalaikin, A.F., 3:21080
**Zeiders, G.W.**, *See* Rather, J.D.G., 3:22020
**Zein el Deen, A.**, *See* Schulz, H., 3:20869, 3:20870
**Zeitlin, B.A.**, *See* Walker, M.S., 3:22592
**Zel'dovich, A.G.**, *See* Ageev, A.I., 3:22107, 3:22108
**Zel'dovich, N.K.**, *See* Ageev, A.I., 3:22107
**Zeldes, H.**, Electron spin resonance study of liquids during photolysis. XXII. The 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions, 3:21990
**Zelenov, B.A.**, *See* Afonin, A.G., 3:22117
**Zelle, B.R.**, *See* Fortune, P.J., 3:22689
**Zeller, H.**, Technical and economical aspects of the LNG market, 3:21787
**Zerbe, J.**, *See* Arola, R., 3:21305
**Zetwood, P.**, *See* Duport, P., 3:22267
**Zhilinskii, A.P.**, Stability boundaries of an argon afterglow, 3:22503
**Zhiryakov, B.M.**, Some features of weak Q switching in a ruby laser resonator, 3:22046
**Zhitnikov, B.Z.**, *See* Ageev, A.I., 3:22107
**Zhokin, A.M.**, *See* Bortnikov, A.V., 3:22555
**Zholudov, Ya.S.**, *See* Borblik, E.L., 3:21763
**Zhukov, I.T.**, *See* Babii, V.I., 3:21527
**Zhuldybin, E.N.**, *See* Zrelov, V.N., 3:21050
**Zigler, A.**, Expansion of a laser-produced aluminium plasma and the heat penetration in multi-layered targets, 3:22475
**Zijl, W.**, *See* Moalem, D., 3:22071
**Zilberman, A.G.**, *See* Amosov, V.V., 3:21013
**Zimmerman, G.**, LASNEX code for inertial confinement fusion, 3:22651 (UCRL—80169)
**Zimmerman, M.D.**, Voyager: running a planetary post pattern, 3:21633
**Zinn, K.G.**, *See* Grimmer, D.P., 3:21378
**Zinov'eva, L.L.**, *See* Ageev, A.I., 3:22107
**Zisman, M.S.**, *See* Stokstad, R.G., 3:22356
**Zmora, H.**, *See* Zigler, A., 3:22475
**Zolotarev, A.A.**, *See* Rabinovich, A.V., 3:21502
**Zook, J.D.**, Silicon on ceramic process. Silicon sheet growth development for the Large-Area Silicon Sheet Task of the Low-Cost Silicon Solar Array Project. Annual report No. 2, September 17, 1976—September 19, 1977, 3:21273 (ERDA/JPL/954356—77/3)
**Zorev, N.N.**, Yttrium aluminum garnet driving oscillator and formation of the spectral radiation composition of a powerful laser, 3:22066 (ORNL-tr—4534)
**Zorin, V.M.**, *See* Margulova, T.Kh., 3:21561
**Zorowski, C.F.**, Modeling and analysis for seismic adequacy in air handling unit enclosures, 3:21613
**Zrelov, V.N.**, Evaluation of reliability of results in determination of content of particular contaminant in jet fuels in accordance with GOST 10557-63, 3:21050
**Zuck, R.K.**, Selective planting for the encouragement of wildlife, 3:21545
**Zvorykin, V.D.**, *See* Basov, N.G., 3:22044
**Zweben, S.J.**, Dynamics of high energy runaway electrons in the Oak Ridge tokamak, 3:22455 (ORNL/TM—6103)
**Zyla, W.**, Sludge from paper production. Final report. Recycling of industrial wastes. Phase II, 3:21840 (BMFT-FB-T—77-08)

# SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms. Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

SUBJECT DESCRIPTOR/QUALIFIER
Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

## A


**A1-1070 RESONANCES/DECAY**
$Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications, 3:22351
**A1-1070 RESONANCES/MASS**
$Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications, 3:22351
**ABSORPTION HEAT/HEAT TRANSFER**
Selection of location for removal of heat of absorption in a tower, 3:20995
**ACCELERATORS**
*See also COLLECTIVE ACCELERATORS*
*HEAVY ION ACCELERATORS*
*LAMPF LINAC*
*LINEAR ACCELERATORS*
*SERPUKHOV SYNCHROTRON*
*SYNCHROTRONS*
*VAN DE GRAAFF ACCELERATORS*
**ACCELERATORS/PLANNING**
Acceleration systems for heavy-ion beams for inertial confinement fusion, 3:22639 (LBL-6768)
**ACCELERATORS/RADIATION PROTECTION**
Radiation protection design guidelines for 0.1 to 100 MeV particle accelerator facilities, 3:22097 (NCRP-51)
**ACCELEROMETERS/CONTROL SYSTEMS**
Control system design using radioactive pickoff (Radioactive proof mass), 3:22127
**ACETATES/HYDROLYSIS**
Kinetic study of the hydrolysis of 2-germaacetate in neutral and alkaline solutions, 3:21958
**ACETIC ACID/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**ACETIC ACID/LIQUID COLUMN CHROMATOGRAPHY**
Concentration and quantitative determination of trace volatile fatty acids in water by liquid chromatography with thermal detector, 3:21931 (BNWL-tr-279)
**ACID ELECTROLYTE FUEL CELLS/ELECTRODES**
Vacuum-microgravimetric characterization of catalyst candidates for fuel cell electrodes, 3:21770
**ACID MINE DRAINAGE/WASTE PROCESSING**
Environmental control technology program studies at Argonne National Laboratory: surface mine effluents, 3:20911 (CONF-7710101-4)
**ACIDS (ORGANIC)**
*See ORGANIC ACIDS*
**ACTINIDES/RADIOACTIVE WASTE DISPOSAL**
Neutronic analysis of a laser-fusion-driven actinide waste burner, 3:22634
**ACTINIUM 223/FRANCIUM**
Nuclear data sheets for A=223, 3:22376
Nuclear data sheets for A=223, 3:22376
**ACTINIUM 223/NUCLEAR STRUCTURE**
Nuclear data sheets for A=223, 3:22376
Nuclear data sheets for A=223, 3:22376
**ACTINIUM 227/NUCLEAR STRUCTURE**
Nuclear data sheets for A=227, 3:22377
**ACTIVATED SLUDGE PROCESS**
Experience in operating biological treating facilities of Angarsk Petrochemical Combine, 3:21010
Treatment of wastewaters from succinimide additive production unit at Perm' Petroleum Refinery, 3:21011
**ACTIVATED SLUDGE PROCESS/BIOCHEMICAL REACTION KINETICS**
Kinetics of biochemical oxidation of refinery wastewaters, 3:21008
**ACTIVATION ANALYSIS/SENSITIVITY**
Advance prediction of neutron activation analysis spectra and detection limits, 3:21928
**ACTIVATION ANALYSIS/SPECTRA**
Advance prediction of neutron activation analysis spectra and detection limits, 3:21928
**ACTIVATION DETECTORS/DESIGN**
Activation detectors for recording pulsed fluxes of fast neutrons, 3:22121 (ORNL-tr-4529)
**ADENOCARCINOMAS**
*See CARCINOMAS*
**ADIABATIC TOROIDAL COMPRESSORS**
*See ATC DEVICES*
**ADVANCED GAS COOLED GRAPHITE REACTOR**
*See AGR TYPE REACTORS*
**AEROSOLS**
*See also RADIOACTIVE AEROSOLS*
**AEROSOLS/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**AEROSOLS/FLOCCULATION**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**AEROSOLS/X-RAY FLUORESCENCE ANALYSIS**
Recent advances in energy-dispersive XRF analysis of aerosol samples, 3:21937
**AFTERBURNERS/EQUIPMENT PROTECTION DEVICES**
After-burning preventive and flame-out apparatus (Patent), 3:21865
**AFTERGLOW/DRIFT INSTABILITY**
Stability boundaries of an argon afterglow, 3:22503
**AFTERGLOW/OSCILLATION MODES**
Stability boundaries of an argon afterglow, 3:22503

**AFTER-HEAT REMOVAL**
Flow visualization in heat-generating porous media (LMFBR), 3:21644 (SAND-76-0614)
**AGR TYPE REACTORS/BLOWERS**
Measurement techniques for AGR circulators in a full-density rig, 3:21661
**AGRICULTURAL WASTES/COMBUSTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
**AGRICULTURE**
*See also FARMS*
**AGRICULTURE/ENERGY CONSUMPTION**
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables (27 crop and 10 livestock commodities), 3:21749 (FEA/D-77/140)
**AGRICULTURE/ENERGY DEMAND**
Agriculture and energy use in the year 2000: discussion of technological changes, 3:21716
Agriculture and energy use in the year 2000: discussion from a natural resource perspective, 3:21717
**AGRICULTURE/ENERGY EFFICIENCY**
Energy policy and research: discussion from the ERDA perspective, 3:21699
**AGRICULTURE/ENERGY MODELS**
Agricultural energy modeling for policy purposes, 3:21718
Agricultural energy modeling: discussion of linear programming models, 3:21719
**AGRICULTURE/ENERGY POLICY**
Energy policy and research: discussion from a land-grant-institution perspective, 3:21700
Energy policy and research in agriculture, 3:21724
**AGRICULTURE/MANAGEMENT**
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress (Recommended actions), 3:21692 (PB-269803)
**AGRICULTURE/RENEWABLE ENERGY SOURCES**
Agriculture and energy use in the year 2000: discussion of technological changes, 3:21716
**AGRICULTURE/RESEARCH PROGRAMS**
Energy policy and research: discussion from the USDA perspective, 3:21698
Energy policy and research: discussion from the ERDA perspective, 3:21699
Energy policy and research: discussion from a land-grant-institution perspective, 3:21700
Energy policy and research in agriculture, 3:21724
**AGRICULTURE/TECHNOLOGY TRANSFER**
Energy policy and research: discussion from the USDA perspective, 3:21698
**AIR**
*See also EARTH ATMOSPHERE*
*SURFACE AIR*
**AIR/CONTAMINATION**
Measurements of $^{222}$Rn in water and indoor airborne $^{222}$Rn originating in water, 3:22221 (HASL-325)
**AIR/RADIATION MONITORING**
Comparison of errors of integrating working level devices (Radon monitoring), 3:22174 (HASL-325)
Design and application of a continuous, digital-output, environmental radon measuring instrument, 3:22176 (HASL-325)
What do we sample for and for how long (Ra and daughter products monitoring), 3:22178 (HASL-325)
**AIR/RADIOACTIVITY**
$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
Radon and daughter measurements with active and passive devices using track etch detectors, 3:22165 (HASL-325)
Some remarks on exact methods for WL and $^{222}$Rn-daughter determination (Monitoring working level radioactivity in uranium mines), 3:22172 (HASL-325)
**AIR/SAMPLING**
Methods used by HASL for ambient radon studies, 3:22166 (HASL-325)
**AIR CONDITIONERS**
*See also SOLAR AIR CONDITIONERS*
**AIR CONDITIONERS/ENERGY DEMAND**
Analysis of energy demands of air-conditioning systems, 3:21782
**AIR CONDITIONING/SEISMIC EFFECTS**
Modeling and analysis for seismic adequacy in air handling unit enclosures, 3:21613
**AIR POLLUTION**
*See also STATIONARY POLLUTANT SOURCES*
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**AIR POLLUTION/ENVIRONMENTAL TRANSPORT**
Application of parameter estimation and hypothesis test for a generalized gamma distribution, 3:22142
**AIR POLLUTION/MATHEMATICAL MODELS**
Application of parameter estimation and hypothesis test for a generalized gamma distribution, 3:22142
First annual report on weather modification effects of cooling towers, 3:22149 (TID-27836)
**AIR POLLUTION/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
Hydrocarbon and oxidant chemistry observed at a site near St. Louis. Final report 30 June 1975-30 June 1976, 3:22145 (PB-269559)
**AIR POLLUTION/SIMULATION**
Oxidant-precursor relationships during pollutant transport conditions. An outdoor smog chamber study. Final report May 1974-November 1975, 3:22147 (PB-269877)
**AIR POLLUTION ABATEMENT**
Nature and formation of nitrogenous air pollutant emissions from combustion systems (Catalytic combustion), 3:21999 (LBL-6850)
**AIR POLLUTION ABATEMENT/EVALUATION**
Environmental protection issues facing the nation (Appraisal by GAO), 3:21688 (PB-269748)
**AIR QUALITY/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
**AIR SAMPLERS/COMPARATIVE EVALUATIONS**
Comparison of errors of integrating working level devices (Radon monitoring), 3:22174 (HASL-325)
**AIR SAMPLERS/COST**
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)
**AIR SAMPLERS/PERFORMANCE**
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)
What do we sample for and for how long (Ra and daughter products monitoring), 3:22178 (HASL-325)
**AIRCRAFT/FUEL ECONOMY**
Factors affecting the corporate decision making process of air transport manufacturers. Final report, 3:21801 (N-77-27020)
**AIRCRAFT/WANKEL ENGINES**
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine, 3:21854 (N-77-26134)
**AIRCRAFT FUELS**
*See AVIATION FUELS*
**ALARM DOSEMETERS**
*See RADIATION MONITORS*
**ALASKA/CONTINENTAL SHELF**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**ALASKA/NATURAL GAS**
Economic analysis of Alaskan royalty gas contracts. A report to State of Alaska: the legislature, 3:21736 (PB-269528)
**ALASKA/OCEANOGRAPHY**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**ALCOHOLS**
*See also ETHANOL*
*GLYCOLS*
*METHANOL*
*2-METHYLPROPANOL*
*XYLENOLS*
**ALCOHOLS/SYNTHESIS**
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data, 3:20870
**ALFALFA/GROWTH**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**ALFVEN WAVES/COUPLING**
Modulation of randomly phased whistler wave packets by kinetic Alfven and ion quasi-modes in a magnetized plasma, 3:22521
**ALFVEN WAVES/EXPLOSIVE INSTABILITY**
Nonlinear instability of electromagnetic drift waves, 3:22482
**ALFVEN WAVES/PARAMETRIC INSTABILITIES**
Nonlinear instability of electromagnetic drift waves, 3:22482
**ALGAE**
*See also PHYTOPLANKTON*
*UNICELLULAR ALGAE*
**ALGAE/BIOCHEMISTRY**
Sphaerococcenol A: a new rearranged bromo-diterpene from the red alga Sphaerococcus coronopifolius, 3:22240

**ALKANES**
*See also METHANE*
*PENTANE*
*PROPANE*
**ALKANES/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**ALKANES/EQUATIONS OF STATE**
Generalized equation of state of liquid n-alkanes, 3:21044
**ALKANES/PURIFICATION**
Hydrocarbon upgrading process (Patent), 3:20986
**ALKANES/PYROLYSIS**
Simulation of product distributions from pyrolysis of normal and branched alkane mixtures over a wide range of conversions, 3:20989
**ALKENOIC ACIDS**
*See CARBOXYLIC ACIDS*
**ALLOYS/MATERIALS WORKING**
Summary report on investigation of metal processing operations. Final report 15 December 1973-22 March 1977, 3:21870 (AD-A-042188)
**ALMARAZ-1 REACTOR/ON-LINE CONTROL SYSTEMS**
Backup computer theory for process control computer systems, 3:21619
**ALMARAZ-2 REACTOR/ON-LINE CONTROL SYSTEMS**
Backup computer theory for process control computer systems, 3:21619
**ALPHA DETECTION**
Instrumentation use in the uranium mill tailings program in Colorado, 3:22182 (HASL-325)
**ALPHA PARTICLES/CARCINOGENESIS**
Cancer induction by alpha emitting warm particles, 3:22254
**ALPHA PARTICLES/MUTAGENESIS**
Cancer induction by alpha emitting warm particles, 3:22254
**ALPHA REACTIONS/INELASTIC SCATTERING**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**ALPHA SOURCES/AUTORADIOGRAPHY**
Alpha-particle autoradiography of geological specimens by use of cellulose nitrate detectors, 3:21132
**ALPHA SOURCES/RADIATION MONITORING**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**ALUMINIUM/CHEMICAL VAPOR DEPOSITION**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**ALUMINIUM/DEPOSITION**
Development of plating thickness standards for the physical vapor deposition of aluminum on Kapton, 3:21873 (BDX-613-1634(Rev.))
**ALUMINIUM/FABRICATION**
Boron/aluminum fan blades for scar engines. Final report, 3:21907 (N-77-26135)
**ALUMINIUM/NEUTRON TRANSPORT**
Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM-6108)
**ALUMINIUM/PHYSICAL RADIATION EFFECTS**
Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM-6108)
**ALUMINIUM/RADIATION TRANSPORT**
Early stages of light interaction with solids at extreme intensities, 3:22443
**ALUMINIUM/RECOVERY**
Aluminum recovery from coal fly ash by high temperature chlorination, 3:20903 (IS-T-777)
**ALUMINIUM/TENSILE PROPERTIES**
Influence of temper condition on the nonlinear stress-strain behavior of boron-aluminum. Interim report, March-October 1976, 3:21908 (N-77-26271)
**ALUMINIUM/THERMAL CONDUCTION**
Expansion of a laser-produced aluminium plasma and the heat penetration in multi-layered targets, 3:22475
**ALUMINIUM/THICKNESS**
Development of plating thickness standards for the physical vapor deposition of aluminum on Kapton, 3:21873 (BDX-613-1634(Rev.))
**ALUMINIUM/VISIBLE RADIATION**
Early stages of light interaction with solids at extreme intensities, 3:22443
**ALUMINIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**ALUMINIUM ALLOYS/DIFFUSION WELDING**
Development and testing of solar water-heated boilers fabricated by diffusion welding, 3:21363
**ALUMINIUM ALLOYS/PROTECTIVE COATINGS**
Wear resistant coatings for titanium alloys. Final report 15 March 1976-15 March 1977 (Cr-Mo coating on Ti-8Al-1V-1Mo substrate), 3:21872 (AD-A-042443)
**ALUMINIUM ALLOYS/TRITIUM RECOVERY**
Recovery of tritium from solid Li-Al and sintered aluminum product (SAP) blanket materials, 3:22635
**ALUMINIUM ARSENIDES/VAPOR PLATING**
Growth and characterization of VPE thin-film AlAs-GaAs heterojunction layers, 3:21300
**ALUMINIUM CHLORIDES/EXCITED STATES**
Deactivation on the $Nd^{3+}$,$^{4}$F/sub 3/2/ level in neodymium chloride-aluminum chloride vapor complexes, 3:21965
**ALUMINIUM CHLORIDES/FLUORESCENCE**
Deactivation on the $Nd^{3+}$,$^{4}$F/sub 3/2/ level in neodymium chloride-aluminum chloride vapor complexes, 3:21965
**ALUMINIUM OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**AMALGAMS**
*See MERCURY ALLOYS*
**AMEBA**
*See AMOEBA*
**AMERICIUM 241/NEUTRON REACTIONS**
Development of an irradiation technology for the recycling of Am-241 in nuclear reactors. A contribution to the possibilities for the reduction of the hazard potential of $\alpha$-bearing wastes, 3:21171 (KFK-2431)
**AMERICIUM 241/RADIATION MONITORING**
Measuring low concentrations of plutonium and americium in earth samples, 3:22202
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**AMINES**
*See also HYDROXYLAMINE*
*METHYLAMINE*
**AMINES/CORROSIVE EFFECTS**
Corrosion control in gas processing plants which remove both $CO_2$ and $H_2S$, 3:21068 (CONF-7603113-)
**AMINES/FLUORESCENCE**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**AMINES/ION EXCHANGE CHROMATOGRAPHY**
Selective concentration of amines from aqueous solutions by a gas purging technique, 3:21945
**AMINES/SOLVENT PROPERTIES**
Selective hydrogen sulfide removal, 3:21075 (CONF-7603113-)
**AMINES/SORPTIVE PROPERTIES**
Activation of water-soluble amines by halogenes for catching radioactive iodine out of air streams (Patent), 3:21176
Fundamentals of gas treating, 3:21071 (CONF-7603113-)
**AMINOGLYCIDES**
*See AMINES*
**AMMONIA/AUGER ELECTRON SPECTROSCOPY**
Experimental Auger electron spectrum of ammonia, 3:21966
**AMMONIA/COST**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**AMMONIA/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**AMMONIA/FLUORESCENCE**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**AMMONIA/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**AMMONIA/SYNTHESIS**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**AMMONIUM COMPOUNDS/CHEMICAL PREPARATION**
Synthesis and structure of bis(tetrapropylammonium) tri-$\mu$-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**AMMONIUM COMPOUNDS/CRYSTAL STRUCTURE**
Synthesis and structure of bis(tetrapropylammonium) tri-$\mu$-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952

**AMMONIUM COMPOUNDS/LABELLING**
Cyclotron production of $^{13}N$ compounds for environmental and biological research, 3:21997
**AMMONIUM COMPOUNDS/MAGNETIC SUSCEPTIBILITY**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**AMNION**
*See FETAL MEMBRANES*
**AMOEBA/TEMPERATURE EFFECTS**
Isolation of pathogenic Naegleria from artificially heated waters, 3:22228 (CONF-770961-3)
**ANAEROBIC DIGESTION**
*See also BIOGAS PROCESS*
**ANAEROBIC DIGESTION/SOLAR HEATING**
Solar powered anaerobic wastewater treatment plant, 3:21361
**ANAEROBIC DIGESTION/SOLAR HEATING SYSTEMS**
Methane gas process and apparatus (Patent), 3:21260
**ANGULAR MOMENTUM OPERATORS/EIGENFUNCTIONS**
Computation of cubic harmonics, 3:22399
**ANHYDRITE/GEOCHEMISTRY**
Experimental investigations on anhydrite. Report No. 2, 3:21195 (DOE-tr-49)
**ANHYDRITE/MECHANICAL PROPERTIES**
Experimental investigations on anhydrite. Report No. 2, 3:21195 (DOE-tr-49)
**ANHYDRITE/PHYSICAL PROPERTIES**
Experimental investigations on anhydrite. Report No. 2, 3:21195 (DOE-tr-49)
**ANHYDRITE/PHYSICAL RADIATION EFFECTS**
Experimental investigations on anhydrite. Report No. 2, 3:21195 (DOE-tr-49)
**ANIMAL CELLS**
*See also TUMOR CELLS*
**ANIMAL CELLS/CYTOLOGY**
View on techniques of preparation of cell and tissue culture specimens for electron microscopy, 3:22233 (LBL-5638)
**ANTENNAS/PERFORMANCE**
Theoretical analysis on radiation and reception characteristics of an oblate spheroidal antenna for electron plasma waves, 3:22429
**ANTHRACITE/COMBUSTION**
Combustion of anthracite in the furnace chamber of a TPP-210 boiler with drying agent feeding through the top tier of principal burners, 3:21496
Nitrogen oxide formation in the fuel spray of a vortex burner burning a mixture of anthracite fines and sludge, 3:21527
**ANTIFERROMAGNETISM/SPECIFIC HEAT**
Formal approach to various properties of antiferromagnets, 3:22391
**ANTIMONY/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**ANTIMONY/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**ANTIMONY 121 TARGET/ARGON 40 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**ANTIMONY ALLOYS/CHEMICAL PREPARATION**
Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972-31 May 1975, 3:21871 (AD-A-042253)
**ANTIMONY ALLOYS/PHYSICAL RADIATION EFFECTS**
Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972-31 May 1975, 3:21871 (AD-A-042253)
**ANTIMONY COMPOUNDS/FILM CONDENSATION**
Superconductivity of rapidly condensed films, 3:21888
**ANTIMONY COMPOUNDS/SUPERCONDUCTIVITY**
Superconductivity of rapidly condensed films, 3:21888
**ANTIMONY OXIDES/CHEMICAL PREPARATION**
Production and properties of antimony(V) aquoxide for the separation of natrium in activation analysis, 3:21973 (IS-Trans-97)
**ANTIMUONS**
*See MUONS PLUS*
**ANTINEUTRINO-NUCLEON INTERACTIONS**
*See also ANTINEUTRINO-PROTON INTERACTIONS*
**ANTINEUTRINO-NUCLEON INTERACTIONS/WEAK NEUTRAL CURRENTS**
Production of charmed particles in weak interactions with diagonal neutral currents, 3:22345
**ANTINEUTRINO-PROTON INTERACTIONS/DIFFERENTIAL CROSS SECTIONS**
Neutrino and antineutrino proton scattering data and the ratio of down to up quarks in the proton, 3:22330
**ANTS**
*See INSECTS*
**APARTMENT BUILDINGS/SOLAR AIR CONDITIONING**
Residential solar heating in Uzbekistan, 3:21335
**APARTMENT BUILDINGS/SOLAR SPACE HEATING**
Residential solar heating in Uzbekistan, 3:21335
**APARTMENT BUILDINGS/SOLAR WATER HEATERS**
Residential solar heating in Uzbekistan, 3:21335
**APARTMENT BUILDINGS/SPACE HEATING**
Influence of ventilation on the optimal thermal protection and thermal comfort of dwellings, 3:21790
**APARTMENT BUILDINGS/TOTAL ENERGY SYSTEMS**
HUD Utilities Demonstration Series. Volume 7. Performance analysis of the Jersey City total energy sits. Interim report, 3:21705 (PB-269517)
**APARTMENT BUILDINGS/VENTILATION**
Influence of ventilation on the optimal thermal protection and thermal comfort of dwellings, 3:21790
**APPARATUS**
*See EQUIPMENT*
**AQUATIC ECOSYSTEMS/MINERAL CYCLING**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**AQUATIC ECOSYSTEMS/NUTRIENTS**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**AQUATIC ORGANISMS**
*(Unspecified biota characteristic of aquatic ecosystems.)*
*See also FISHES*
*MOLLUSCS*
**AQUATIC ORGANISMS/BIOLOGICAL RECOVERY**
Study of the effects of the San Francisco oil spill on marine organisms, 3:22269 (CONF-730386-)
**AQUATIC ORGANISMS/BIOMASS**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**AQUATIC ORGANISMS/DIFFUSION**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**AQUATIC ORGANISMS/POLLUTION**
Interagency investigations of a persistent oil spill on the Washington Coast, 3:22270 (CONF-730386-)
**AQUATIC ORGANISMS/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**AQUATIC ORGANISMS/SAMPLING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**AQUIFERS/GAS INJECTION**
Hydrodynamic investigation of gas volume dynamics in a stratum of constant thickness, 3:21099
**ARC FURNACES/FUEL ECONOMY**
Assessment of current practice with regard to charge preheating in electrometallurgy, 3:21838
**ARC WELDING**
Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress, 3:21874 (ZJE-186)
**ARCHAEOLOGICAL SPECIMENS/X-RAY EMISSION ANALYSIS**
Proton-induced x-ray emission multielement analysis in biomedical, environmental, geological, and archaeological specimens, 3:21940
**ARCHAEOLOGY**
Archaeological and historical investigations for energy facilities: a state of the art report, 3:21685 (TID-28070)
**ARGENTINA/GEOTHERMAL RESOURCES**
Where is Argentina going in geothermal energy, 3:21395 (NP-22124)
**ARGENTINA/HYDROTHERMAL SYSTEMS**
Argentine hydrothermal panorama, 3:21394 (CONF-761219-)
**ARGENTINA/THERMAL WATERS**
Argentine hydrothermal panorama, 3:21394 (CONF-761219-)
**ARGON/ATOM-MOLECULE COLLISIONS**
Quasiclassical trajectory study of the energy transfer in $CO_2$-rare gas systems, 3:22319
**ARGON/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**ARGON/MOLECULE-MOLECULE COLLISIONS**
Direct calculation of the equilibrium value of the energy of activation for dissociation of $H_3$ by Ar and evidence for the important contribution of collisional dissociation from low vibrational quantum numbers and high rotational quantum numbers at shock tube temperatures, 3:21954

**ARGON 40 REACTIONS/COMPOUND-NUCLEUS REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
Experimental study of Yb nuclei at high angular momentum, 3:22369
**ARGON 40 REACTIONS/FUSION REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**ARGON IONS/ELECTRONIC STRUCTURE**
Electronic states of $Ar^+_2$, $Kr^+_2$, $Xe^+_2$. I. Potential curves with and without spin-orbit coupling, 3:22308
**ARID LANDS/MANAGEMENT**
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress (Recommended actions), 3:21692 (PB-269803)
**ARIZONA/URANIUM DEPOSITS**
Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX-78(77))
**AROMATICS**
*See also BENZENE*
*DDT*
*TETRALIN*
*TOLUENE*
*XYLENES*
**AROMATICS/BIOLOGICAL EFFECTS**
Environmental significance of fin erosion in Southern California demersal fishes (Microstomus pacificus), 3:22219
**ARSENIC/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**ARSENIC/ACTIVATION ANALYSIS**
Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean, 3:21925
**ARSENIC/POLAROGRAPHY**
Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76, 3:22212 (PB-269652)
**ARSENIC COMPOUNDS/ORDER-DISORDER TRANSFORMATIONS**
One-dimensional phonons and "phase-ordering" phase transition in a Hg-As-F compound, 3:21914
**ARSONIUM COMPOUNDS**
*See ARSENIC COMPOUNDS*
**ASHES**
*See also FLY ASH*
**ASHES/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**ASHES/CHEMICAL COMPOSITION**
Chemical equilibrium in ash-laden coal combustion systems, 3:20890 (FE-2205-7)
Investigation of the behavior of the mineral matter of acid composition in high temperature combustion of coal, 3:20930
**ASHES/CONVEYORS**
In-plant coal and ash handling overview, 3:21484 (CONF-770658-)
**ASPHALTENES/MOLECULAR WEIGHT**
Molecular weight and association of coal-derived asphaltenes, 3:20895
**ASPHALTS**
*See also ASPHALTENES*
**ASPHALTS/PRODUCTION**
Production of paving asphalts from high-wax crudes in fuel-profile refineries, 3:21002
**ASTATINE 215/NUCLEAR STRUCTURE**
Nuclear data sheets for A=215, 3:22372
**ASTATINE 219/NUCLEAR STRUCTURE**
Nuclear data sheets for A=219, 3:22373
**ASTROCYTOMAS**
*See NEOPLASMS*
**ATC DEVICES/ION TEMPERATURE**
Ion temperature scaling on Jaeri tokamaks, 3:22412
**ATLANTIC OCEAN**
*See also NORTH SEA*
**ATLANTIC OCEAN/HYDRODYNAMICS**
Currents along the Northwest African coast South of 22° North, 3:22288
**ATOMIC BOMBS**
*See NUCLEAR WEAPONS*
**ATOMIC EXPLOSIONS**
*See NUCLEAR EXPLOSIONS*
**ATOMIC WEAPONS**
*See NUCLEAR WEAPONS*
**ATOM-MOLECULE COLLISIONS/DE-EXCITATION**
Deactivation of vibrationally excited ozone by $O(^3P)$ atoms, 3:22322
**ATOMS**
*See also MUONIC ATOMS*
**ATOMS/PHOTOIONIZATION**
Angular distributions of photoelectrons and non-thermal photoions from atoms and molecules (Review), 3:22314 (CONF-770935-4)
**AUGER MINING/EFFICIENCY**
Coal recovery from bituminous coal surface mines in the eastern United States: a survey. Information circular, 3:20917 (PB-269914)
State-of-the-art of functional use data measuring energy consumption in the commercial sector. Final report, 3:21797 (PB-269906)
**AUSTRALIA**
*See also SOUTH AUSTRALIA*
**AUSTRALIA/NATURAL GAS INDUSTRY**
Australia examines gas industry's future, 3:21737
**AUSTRALIA/URANIUM RESERVES**
Recent development of the process and mineral industries in Australia, 3:21111
**AUTOMOBILE EXHAUST REACTORS**
*See AFTERBURNERS*
**AUTOMOBILES/AIR POLLUTION**
Lead, expecially exhaust lead, in the terrestrial environment: accumulation and ecological effects. A literature survey, 3:22148 (SNV-PM-794)
**AUTOMOBILES/EXHAUST GASES**
Lead, expecially exhaust lead, in the terrestrial environment: accumulation and ecological effects. A literature survey, 3:22148 (SNV-PM-794)
**AUTOMOBILES/FLYWHEEL ENERGY STORAGE**
Evaluation of selected drive components for a flywheel powered commuter vehicle. Phase I. Final report, 3:21858 (SAN/1164-1)
**AUTOMOBILES/FUEL ECONOMY**
Uncertainties in estimates of fleet average fuel economy: a statistical evaluation. Final report November 1975-November 1976, 3:21804 (PB-270025)
What use are econometers. Greater discipline in driving by fuel consumption indicating devices, 3:21864
**AUTOMOBILES/SPARK IGNITION ENGINES**
Investigative study of engine limiting, 3:21860 (BERC/RI-77/13)
**AUTOMOBILES/STIRLING ENGINES**
Stirling engine feasibility study of an 80 to 100 hp engine and of improvement potential for emissions and fuel economy. Final report, 3:21855 (COO-2631-22)
**AUTOMOTIVE FUELS**
Reciprocating internal combustion engine for operation with fuel in powder form (Patent), 3:21861
**AUTOMOTIVE FUELS/DETERGENTS**
Mannich Bases containing tertiary amines and fuel compositions containing said Mannich Bases (Patent), 3:21982
**AUTOMOTIVE FUELS/FEASIBILITY STUDIES**
Methanol from natural gas for engine fuel. 2nd interim report. Report No. 23, 3:21868 (NP-22771)
**AUTOMOTIVE FUELS/METHANOL**
Methanol as an automotive fuel, 3:21869
**AUXILIARY SYSTEMS/AIR CONDITIONING**
Modeling and analysis for seismic adequacy in air handling unit enclosures, 3:21613
**AVIATION FUELS/ADDITIVES**
Effect of naphthols on the thermal stability of fuels, 3:21054 (N-77-26322)
**AVIATION FUELS/IMPURITIES**
Evaluation of reliability of results in determination of content of particular contaminant in jet fuels in accordance with GOST 10557-63, 3:21050

## B

**BACKGROUND RADIATION**
Background working levels and the remedial action guidelines, 3:22183 (HASL-325)
**BACTERIA**
*See also MICROCOCCUS*
**BACTERIA/POPULATION DYNAMICS**
Effect of a bunker fuel on the beach bacterial flora, 3:22273 (CONF-730386-)
**BAGHOUSES/COST**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
**BAGHOUSES/PERFORMANCE**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
**BARITE/GEOTHERMOMETRY**
Oxygen and sulfur isotope equilibria in the $BaSO_4$-$HSO_4^-$-$H_2O$ system from 110 to 350°C and applications, 3:21457

**BARIUM/CHEMILUMINESCENCE**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**BARIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**BARIUM 134/ENERGY LEVELS**
Decay of $^{134}$La, 3:22360 (TREE-1115)
**BARYONS/BOUNDARY CONDITIONS**
Chiral symmetry breaking and the quark model: unification of baryon and meson constraints (Review), 3:22352
**BARYONS/MASS SPECTRA**
Chiral symmetry breaking and the quark model: unification of baryon and meson constraints (Review), 3:22352
**BEAM DYNAMICS**
*(Particle beam motion inside an accelerator.)*
Increase of the beam radius and particle oscillations due to errors in proton linear accelerators, 3:22106 (LA-tr-77-89)
Synchrotron acceleration of variable charge heavy ions, 3:22105 (UCRL-Trans-1541)
**BEAM DYNAMICS/DEPOLARIZATION**
Beam depolarization in the magnetic field of a synchrotron, 3:22104
**BEAM-PLASMA SYSTEMS/BEAM NEUTRALIZATION**
Neutralization of the charge of an electron beam in a plasma, 3:22468
**BEAM-PLASMA SYSTEMS/CYCLOTRON INSTABILITY**
K-spectrum analysis of the nonlinear time development of the electron cyclotron instability, 3:22489
**BEAM-PLASMA SYSTEMS/ION SOURCES**
Formation of strong E-layers by intense electron-beam injection into preformed plasmas, 3:22406
**BEAM-PLASMA SYSTEMS/ION WAVE INSTABILITY**
Experiments on current-driven three-dimensional ion sound turbulence. Part I: Return-current limited electron beam injection, 3:22483
Experiments on current-driven three-dimensional ion sound turbulence. Part II: Wave dynamics, 3:22484
**BEAM-PLASMA SYSTEMS/MAGNETIC FIELD REVERSAL**
Magnetic field reversal induced by an intense rotating electron beam in an initially neutral gas, 3:22405
**BEAM-PLASMA SYSTEMS/PLASMA CONFINEMENT**
Magnetic field reversal induced by an intense rotating electron beam in an initially neutral gas, 3:22405
**BEAM-PLASMA SYSTEMS/PLASMA DIAGNOSTICS**
Spatially resolved EUV emission from focused REB discharges into thin targets, 3:22427
**BEAM-PLASMA SYSTEMS/PLASMA WAVES**
Suppression of the plasma oscillation by a wave perturbation on the beam distribution function, 3:22518
**BEAM-PLASMA SYSTEMS/TWO-STREAM INSTABILITY**
Self-oscillations excited by two stream ion-ion instability, 3:22490
**BEARINGS/DESIGN**
Segmental radial bearings for high-capacity turbines, 3:21490
**BEES**
*See INSECTS*
**BELGIUM/URANIUM DEPOSITS**
Prospects for uranium exploration on a national scale, 3:21133
**BENZENE/BIOLOGICAL EFFECTS**
Respiratory response of juvenile chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil, 3:22275 (CONF-730386-)
**BENZENE/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**BENZENE/THERMODYNAMIC PROPERTIES**
Experimental investigation of P-V-T dependence of cyclohexane and benzene at the melting line, 3:21042
**BERYLLIUM/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**BERYLLIUM 7/ENVIRONMENTAL TRANSPORT**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**BERYLLIUM 7/RADIATION MONITORING**
High altitude balloon sampling program (Fallout monitoring), 3:22157 (EML-334)
**BERYLLIUM 7/RADIOMETRIC ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**BERYLLIUM 9 TARGET/PROTON REACTIONS**
Measurement of the dihadron mass continuum in p-Be collisions and a search for narrow resonances, 3:22334
**BERYLLIUM MODERATORS**
*See BERYLLIUM*
**BESSEL FUNCTIONS/COMPUTER CALCULATIONS**
Roots of two transcendental equations determining the frequency spectra of standing spherical electromagnetic waves, 3:22402
**BETA DOSIMETRY/ERRORS**
Continuous working level monitor (Radon daughters in uranium mine air), 3:22175 (HASL-325)
**BIKINI/RADIATION MONITORING**
Evaluation of the radionuclide concentrations in soil and plants from the 1975 terrestrial survey of Bikini and Eneu Islands, 3:22201 (UCRL-51879(Pt.3))
**BINARY STARS/COSMIC X-RAY SOURCES**
OSO-8 x-ray observations of AM Hersoulis, 3:22296 (N-77-27050)
**BIOGAS PROCESS/RESEARCH PROGRAMS**
Swedish methane gas project: a proposal with three alternatives, 3:21262
**BIOLOGICAL MATERIALS**
*(See also specific biological materials.)*
*See also BIOMASS*
*FOOD*
*MILK*
*PLANTS*
*TISSUES*
**BIOLOGICAL MATERIALS/NEUTRON DIFFRACTION**
Correction factors for neutron diffraction from lamellar structures, 3:22388
**BIOLOGICAL MATERIALS/X-RAY EMISSION ANALYSIS**
Proton-induced x-ray emission multielement analysis in biomedical, environmental, geological, and archaeological specimens, 3:21940
**BIOMASS**
*(All growing organic matter such as plants, trees, grasses, and algae.)*
*See also PLANTS*
**BIOMASS/COMBUSTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
**BIOMASS/GASIFICATION**
Rotary kiln gasification of biomass and municipal wastes, 3:21303 (CONF-770235-)
**BIOMASS/PRODUCTION**
Survival and dry matter production of some high-yield clones of SALIX and POPULUS selected for forest industry and energy production. Pilot study, 3:21259 (SHS-IFSY-RU-3)
**BIOMASS/THERMOCHEMICAL PROCESSES**
Facility deficiencies, 3:22082 (CONF-770235-)
Fuels from biomass program: thermochemical coordination meeting, 3:21302 (CONF-770235-)
**BIOMASS/WASTE PROCESSING**
Facility deficiencies, 3:22082 (CONF-770235-)
**BIOMASS PLANTATIONS/FEASIBILITY STUDIES**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**BIOPHYSICS/RESEARCH PROGRAMS**
Physico-chemical study of some areas of fundamental significance to biophysics. Final report, 1974-1977, 3:21978 (ORO-3018-180)
**BIRDS/BASELINE ECOLOGY**
Recapturing radio-tagged ruffed grouse by nightlighting and snow-burrow netting, 3:22209
**BISMUTH/ACTIVATION ANALYSIS**
Determination of bismuth by photon activation analysis, 3:21927
**BISMUTH 214/RADIATION MONITORING**
Estimation of $^{222}$Rn daughter doses from large-area sources, 3:22195
Variation of radon and radon daughter concentrations with height above ground, 3:22177 (HASL-325)
**BISMUTH OXIDES/PHASE DIAGRAMS**
Solid phases of the $Bi_2O_3$-PbO system: identification and evolution as a function of temperature, 3:21900 (SAND-77-6024)
**BITTER SPAR**
*See DOLOMITE*
**BITUMENS**
*See also ASPHALTS*
**BITUMENS/MASS SPECTROSCOPY**
Mass spectrometric analytical services and research activities to support coal-liquid characterization research. Quarterly report, June 9-September 30, 1977, 3:20874 (BERC-0020-9)
**BITUMENS/RECOVERY**
Evaluation of pump used for in situ oil recovery from tar sands, 3:21103 (MTI-78TR16)
**BITUMINOUS COAL/DESULFURIZATION**
Coal liquefaction and desulfurization, utilizing synthesis gas (Patent), 3:20884

**BITUMINOUS COAL/PRODUCTION**
Bituminous coal and lignite distribution. Calendar year 1976, 3:20934
**BITUMINOUS COAL/PYROLYSIS**
Development program for MHD power generation: coal devolatilization. Final report, Volume VI, July 1, 1975-September 30, 1976 (Exhaust gas from MHD generator used to pyrolyze coal for production of clean fuel gas of CO and H2), 3:20855 (FE-2015-20)
**BLACK SHALES/CHEMICAL COMPOSITION**
Organic composition of Devonian Shale from Perry County, Kentucky, 3:21102 (MERC/TPR-77/3)
**BLACK SHALES/X-RAY RADIOGRAPHY**
Some practical considerations in x-radiography, 3:21101 (MERC/SP-77/7)
**BLANKETS (BREEDING)**
*See BREEDING BLANKETS*
**BLAST FURNACES/FUEL FEEDING SYSTEMS**
Blast furnace coal injection at Armco's Ashland Works, 3:21809 (CONF-770658-)
**BLOOD FLOW/MEASURING METHODS**
Blood flow imaging with nuclear magnetic resonance, 3:22242
**BLOWDOWN/HYDRODYNAMICS**
One-Third-Scale Air-Water Pump Program, LOCA and pump overspeed analyses. Final report (PWR), 3:21639 (EPRI-NP-474)
**BLOWDOWN/TWO-PHASE FLOW**
One-Third-Scale Air-Water Pump Program, alternate analytical pump performance data (PWR), 3:21638 (EPRI-NP-385(Vol.1))
**BLOWERS/FAILURES**
Measurement techniques for AGR circulators in a full-density rig, 3:21661
**BLOWERS/MECHANICAL VIBRATIONS**
Measurement techniques for AGR circulators in a full-density rig, 3:21661
**BOILER FUEL/COMBUSTION PRODUCTS**
Nitrogen oxide formation in the fuel spray of a vortex burner burning a mixture of anthracite fines and sludge, 3:21527
**BOILERS/AIR POLLUTION ABATEMENT**
Field testing: application of combustion modifications to control pollutant emissions from industrial boilers. Phases I and II (data supplement). Supplemental report for June 1973-September 1975, 3:22092 (PB-270112)
**BOILERS/CORROSION**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
**BOILERS/CORROSION PROTECTION**
Boiler conservation during stoppages, 3:21512
**BOILERS/DESIGN**
Combustion of anthracite in the furnace chamber of a TPP-210 boiler with drying agent feeding through the top tier of principal burners, 3:21496
Industry capability to supply equipment, 3:21812 (CONF-770658-)
Present-day problems of boiler engineering, 3:21492
**BOILERS/FABRICATION**
Development and testing of solar water-heated boilers fabricated by diffusion welding, 3:21363
**BOILERS/FOULING**
Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils, 3:21049
**BOILERS/FUEL SUBSTITUTION**
Institutional boiler conversion, 3:22084 (CONF-770658-)
**BOILERS/MAINTENANCE**
Boiler conservation during stoppages, 3:21512
**BOILERS/MODIFICATIONS**
Field testing: application of combustion modifications to control pollutant emissions from industrial boilers. Phases I and II (data supplement). Supplemental report for June 1973-September 1975, 3:22092 (PB-270112)
**BOILERS/OPERATION**
Investigation of slghtly nonisothermal models of recirculation of gases into the top part of furnace chambers of high-capacity boilers, 3:21494
Specific features of starting operating conditions of a TGMP-324 gastight boiler of a 300 MW monoblock, 3:21493
**BOILERS/SLAGS**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
**BOILERS/TESTING**
Development and testing of solar water-heated boilers fabricated by diffusion welding, 3:21363
**BOILING WATER REACTORS**
*See BWR TYPE REACTORS*
**BONE TISSUES/RADIOMETRIC ANALYSIS**
Analyses of quality control samples at EML and a contractor laboratory during 1977 (Samples of bone, food, tap water and fallout $^{90}Sr$, $^{137}Cs$), 3:22143 (EML-334)
**BONES**
*See SKELETON*
**BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**BOREHOLES/CLASSIFICATION**
Selection of objects for exerting an effect on bottom hole zone, given a great number of dependent characteristics, 3:20967
**BORON/FABRICATION**
Boron/aluminum fan blades for scar engines. Final report, 3:21907 (N-77-26135)
**BORON/TENSILE PROPERTIES**
Influence of temper condition on the nonlinear stress-strain behavior of boron-aluminum. Interim report, March-October 1976, 3:21908 (N-77-26271)
**BORON ISOTOPES/ISOTOPE SEPARATION**
Method for separation and enrichment of isotopes (Patent), 3:21142
**BOUNDARY-VALUE PROBLEMS/NUMERICAL SOLUTION**
Comments on the comparison of global methods for linear two-point boundary value problems, 3:22401
**BRAZIL/MINERAL RESOURCES**
Mineral exploration and mining in Brasil--1977, 3:20915
**BREAKERS (CIRCUIT)**
*See CIRCUIT BREAKERS*
**BREAKWATERS**
*See DAMS*
**BREATH/SAMPLING**
Radon and radon daughters: measurement and analysis successes and difficulties experienced by EPA, 3:22180 (HASL-325)
**BREATHING**
*See BREATH*
**BREEDING BLANKETS/COST**
Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER-582)
**BREEDING BLANKETS/FABRICATION**
Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER-582)
**BREEDING BLANKETS/HYDRAULICS**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**BREEDING BLANKETS/HYDRODYNAMICS**
Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**BREEDING BLANKETS/MECHANICAL PROPERTIES**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**BREEDING BLANKETS/NEUTRON SPECTRA**
Determination of fast neutron spectra with activation techniques: its application in a fusion reactor blanket model, 3:22581
**BREEDING BLANKETS/PERFORMANCE**
MIT LMFBR blanket research project. Quarterly progress report, July 1, 1977-September 30, 1977, 3:21580 (COO-2250-30)
**BREEDING BLANKETS/STRESS ANALYSIS**
Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**BREEDING BLANKETS/THERMAL STRESSES**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**BREEDING BLANKETS/THERMODYNAMIC PROPERTIES**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**BREEDING BLANKETS/TRITIUM RECOVERY**
Recovery of tritium from solid Li-Al and sintered aluminum product (SAP) blanket materials, 3:22635
**BRINES/CORROSIVE EFFECTS**
Development of geothermal energy: some problems, 3:21447
**BROMIDES/CRYSTAL STRUCTURE**
Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate, 3:21970
**BROMINATED ALIPHATIC HYDROCARBONS/ELECTRONIC STRUCTURE**
Structure and energetics of simple carbenes $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$, 3:21981
**BROMINE COMPOUNDS/CHEMICAL PREPARATION**
Synthesis and structure of bis(tetrapropylammonium) tri-$\mu$-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**BROMINE COMPOUNDS/CRYSTAL STRUCTURE**
Synthesis and structure of bis(tetrapropylammonium) tri-$\mu$-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952

**BROMINE COMPOUNDS/MAGNETIC SUSCEPTIBILITY**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**BUBBLE CHAMBERS/HYBRID SYSTEMS**
Hybrid bubble chamber systems, 3:22126
**BUILDING MATERIALS**
*See also CEMENTS*
**BUILDING MATERIALS/CONTAMINATION**
$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
**BUILDING MATERIALS/ECONOMICS**
Economics of energy and materials, 3:21816
**BUILDING MATERIALS/HEAT TRANSFER**
Thermally insulated panel (Patent), 3:21774
**BUILDING MATERIALS/MECHANICAL PROPERTIES**
Strengths of building blocks containing shaped cavities for thermal insulation and rectification, 3:21777
**BUILDING MATERIALS/RADIOACTIVITY**
Application of field spectrometry to radiation studies in phosphate regions, 3:22188 (HASL-325)
**BUILDING MATERIALS/RECYCLING**
Economics of energy and materials, 3:21816
**BUILDING MATERIALS/STRESS ANALYSIS**
Strengths of building blocks containing shaped cavities for thermal insulation and rectification, 3:21777
**BUILDINGS**
*See also APARTMENT BUILDINGS*
*COMMERCIAL BUILDINGS*
*HOSPITALS*
*HOUSES*
*OFFICE BUILDINGS*
*SCHOOL BUILDINGS*
**BUILDINGS/ENERGY CONSERVATION**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)
Conservation of energy through state action, 3:21783
Cutting fuel costs, 3:21779
**BUILDINGS/ENERGY EFFICIENCY**
Selected papers from a conference entitled "Focusing on Energy" (6 Papers), 3:21708 (IMMR-24-M3-76)
**BUILDINGS/FUEL CONSUMPTION**
Cutting fuel costs, 3:21779
**BUILDINGS/PASSIVE SOLAR HEATING SYSTEMS**
Cortade Library: system performance of first vertical wall passive solar collector array in Orange, Virginia (private library retrofit), 3:21342
**BUILDINGS/RADIATION MONITORING**
$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
Background working levels and the remedial action guidelines, 3:22183 (HASL-325)
Comparison of errors of integrating working level devices (Radon monitoring), 3:22174 (HASL-325)
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
**BUILDINGS/RADIOACTIVITY**
Radon and radon daughter measurements and methods utilized by EPA's Eastern Environmental Radiation Facility (Radioactivity of air in buildings constructed on land reclaimed from phosphate mining), 3:22189 (HASL-325)
**BUILDINGS/SOLAR HEATING SYSTEMS**
Installation and testing of a solar heating system for an aquatic recreational facility, 3:21345
**BUILDINGS/THERMAL INSULATION**
Urea-formaldehyde based foam insulations: an assessment of their properties and performance. Final report, 3:21773 (PB-269779)
**BUILDINGS/VENTILATION**
Ventilation measurements as an adjunct to radon measurements in buildings, 3:22190 (HASL-325)
**BUILDINGS/WINDOWS**
Insulating spacer for double insulated glass (Patent), 3:21775
**BUNKER OILS**
*See RESIDUAL FUELS*
**BUREAU OF MINES**
*See US BUREAU OF MINES*
**BURNERS**
*See also COMBUSTORS*
*FLUIDIZED-BED COMBUSTORS*
**BURNERS/DESIGN**
Combustion of anthracite in the furnace chamber of a TPP-210 boiler with drying agent feeding through the top tier of principal burners, 3:21496
Combustion heating apparatus to improve operation of gas pilot burners (Patent), 3:22085
Effect of design characteristics of centrifugal injectors on liquid discharge coefficient, 3:22088
Waste burner overfire draft system (Patent), 3:21842
**BURNERS/NOZZLES**
Effect of design characteristics of centrifugal injectors on liquid discharge coefficient, 3:22088
**BURNUP/SIMULATION**
Study of uranium-plutonium carbide-based fuel simulating high burnup, 3:21150
**BURST CAN MONITORS**
*See FAILED ELEMENT MONITORS*
**BURST SLUG MONITORS**
*See FAILED ELEMENT MONITORS*
**BWR TYPE REACTORS/COOLANT CLEANUP SYSTEMS**
Chemistry of feedwater for boiling-water and pressurized-water reactors (Condensate polishing plants), 3:21558
**BWR TYPE REACTORS/FUEL CANS**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report, 3:21556 (EPRI-NP-567)
**BWR TYPE REACTORS/LOSS OF COOLANT**
BWR Mark I pressure suppression study: bench mark experiments, 3:21649 (UCID-17661)
BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function, 3:21650 (UCID-17662)
One-Third-Scale Air-Water Pump Program: test program and pump performance, 3:21637 (EPRI-NP-135)
Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, July-September 1977, 3:21648 (TREE-NUREG-1188)
Suppression pool dynamics. Quarterly progress report, April 1-June 30, 1977, 3:21642 (NUREG-0264-4)
**BWR TYPE REACTORS/PRIMARY COOLANT CIRCUITS**
One-Third-Scale Air-Water Pump Program: test program and pump performance, 3:21637 (EPRI-NP-135)
**BWR TYPE REACTORS/RADIOACTIVE EFFLUENTS**
Procedures: Source Term Measurement Program, 3:21623 (NUREG-0384)
**BWR TYPE REACTORS/RADIOACTIVE WASTE PROCESSING**
Recombinator of hydrogen and oxygen (Patent), 3:21177
**BWR TYPE REACTORS/REACTOR COOLING SYSTEMS**
Assessment of two-phase pressure drop correlations for steam-water systems, 3:21559
Some problems of optimization of thermal diagrams of single-loop nuclear power plants, 3:21561
**BWR TYPE REACTORS/REACTOR KINETICS**
Lattice physics methods. Licensing topical report, 3:21557 (NEDO-20913A)
**BWR TYPE REACTORS/STEAM LINES**
Concerning a relation in piston compressor thermodynamics, 3:21560

## C

**CADMIUM/ABSORPTION SPECTROSCOPY**
Cd ion activity in soils: evaluation of Cd ion-selective electrode, 3:21930
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**CADMIUM/BIOLOGICAL EFFECTS**
Stimulation of informosomal RNA synthesis in cultured Chinese hamster cells exposed to low levels of cadmium, 3:22272
**CADMIUM/CHEMICAL ANALYSIS**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**CADMIUM/CHEMICAL VAPOR DEPOSITION**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**CADMIUM/ION SELECTIVE ELECTRODE ANALYSIS**
Cd ion activity in soils: evaluation of Cd ion-selective electrode, 3:21930
**CADMIUM/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**CADMIUM 109/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**CADMIUM 114/ROTATIONAL STATES**
Evidence for the coexistence of shapes in even-mass Cd nuclei, 3:22357
**CADMIUM ALLOYS/MAGNETIC SUSCEPTIBILITY**
Magnetic properties of zinc and of cadmium alloys with magnesium and with mercury, 3:21890

**CADMIUM COMPOUNDS/CRYSTAL STRUCTURE**
Crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ and $Cd_3[Co(CN)_6]_2.12H_2O$ by neutron and x-ray diffraction, 3:21956
**CADMIUM COMPOUNDS/EMISSION SPECTROSCOPY**
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T-741)
**CADMIUM COMPOUNDS/PHYSICAL RADIATION EFFECTS**
Electrical and recombination characteristics of Cd/sub x/Hg/sub 1-x/Te irradiated with electrons at T=300° K, 3:21897
**CADMIUM SULFIDE SOLAR CELLS/FABRICATION**
CdS-CdTe solar cell prepared by vapor phase epitaxy, 3:21286
Technology of large area $Cu_2S$-CdS solar cells, 3:21287
Thin film solar cells for terrestrial applications. Quarterly progress report no. 4, 1 April-30 June 1975, 3:21282 (PB-269671)
**CADMIUM SULFIDE SOLAR CELLS/SERVICE LIFE**
Thin film solar cells for terrestrial applications. Quarterly progress report no. 4, 1 April-30 June 1975, 3:21282 (PB-269671)
**CADMIUM SULFIDES/PRODUCTION**
Technology of large area $Cu_2S$-CdS solar cells, 3:21287
**CADMIUM SULFIDES/VAPOR PLATING**
CdS-CdTe solar cell prepared by vapor phase epitaxy, 3:21286
**CADMIUM TELLURIDE SOLAR CELLS/FABRICATION**
CdS-CdTe solar cell prepared by vapor phase epitaxy, 3:21286
**CALCIUM/ACTIVATION ANALYSIS**
Quantitation of the degree of osteoporosis by measure of total-body calcium employing neutron activation, 3:22244
**CALCIUM/MEMBRANE TRANSPORT**
Placental transport of radionuclides. Terminal report, May 1, 1973-July 31, 1975 (Tritiated water, tritium, $^{14}C$, $^{48}C$, and $^{47}C$ tracers), 3:22268 (COO-2363-4)
**CALCIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**CALCIUM COMPOUNDS/EMISSION SPECTROSCOPY**
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T-741)
**CALIFORNIA**
*See also IMPERIAL VALLEY*
**CALIFORNIA/CLIMATES**
Impacts of the western drought on the regional electricity situation, 3:21743 (TID-28064)
**CALIFORNIA/FALLOUT**
EML fallout program data, 3:22155 (EML-334)
**CALIFORNIA/GEOTHERMAL ENERGY**
Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power, 3:21427 (SAN-115P108-1(Vol.2))
Economic analyses of geothermal energy development in California, 3:21428 (SAN-115P108-1(Vol.1))
**CALIFORNIA/OIL FIELDS**
Improved secondary oil recovery by controlled water flooding-pilot demonstration Ranger Zone, Fault Block VII, Wilmington Field. Phase I. Quarterly report, July-September 1977, 3:20959 (SAN/1396-12)
**CALIFORNIA/TAXES**
State taxation of geothermal resources compared with state taxation of other energy minerals, 3:21431
**CALIFORNIA/URANIUM DEPOSITS**
Preliminary study of the uranium favorability of granitic and contact-metamorphic rocks of the Owens Valley area, Inyo and Mono Counties, California, and Esmeralda and Mineral Counties, Nevada, 3:21120 (GJBX-3(78))
**CALIFORNIUM 252/SPONTANEOUS FISSION**
Review of microscopic integral cross section data in fundamental reactor dosimetry benchmark neutron fields, 3:22378 (HEDL-SA-1148(Rev.1))
**CAMAC SYSTEM**
*(Computer Application to Measurement And Control.)*
Micro-NOVAC: an intelligent CAMAC controller based on a micro-NOVA computer, 3:22078 (LA-6985)
**CANADA**
*See also NORTHWEST TERRITORIES*
*ONTARIO*
*QUEBEC*
*SASKATCHEWAN*
**CANADA/ENERGY POLICY**
Sources, availability and cost of future energy, 3:21713 (AECL-5816)
**CANADA/ENERGY SOURCES**
Sources, availability and cost of future energy, 3:21713 (AECL-5816)
**CANADA/HEAT FLOW**
Geothermal studies in the MacKenzie Valley by the Earth Physics Branch, 3:21411
**CANADA/INSOLATION**
Hourly solar radiation data for vertical and horizontal surfaces on average days in the United States and Canada (80 locations), 3:21267 (NBS-BSS-96)
**CANADA/NUCLEAR POWER**
Nuclear energy: nasty or necessary, 3:21702
**CANCER**
*See NEOPLASMS*
**CANONICAL EQUATIONS**
*See DIFFERENTIAL EQUATIONS*
**CARBON**
*See also GRAPHITE*
*PYROLYTIC CARBON*
**CARBON/CHARGED-PARTICLE TRANSPORT**
Effects seen in the interactions of fast molecular-ion beams with matter (Angular distributions, dissociation, polorization, energy losses, transmitted fractions), 3:22311 (CONF-770931-4)
**CARBON/GAS CHROMATOGRAPHY**
Spectroscopic element detector for gas chromatography, 3:21929
**CARBON/ION COLLISIONS**
Effects seen in the interactions of fast molecular-ion beams with matter (Angular distributions, dissociation, polorization, energy losses, transmitted fractions), 3:22311 (CONF-770931-4)
**CARBON/SPECTROSCOPY**
Spectroscopic element detector for gas chromatography, 3:21929
**CARBON 12/CHARGE DISTRIBUTION**
Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$, 3:22354
**CARBON 12 TARGET/NITROGEN 14 REACTIONS**
Measurements of the fusion of $^{12}C + {}^{14}N$ and the liquid-drop limit for $^{26}Al$, 3:22356
**CARBON 12 TARGET/PROTON REACTIONS**
Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$, 3:22354
**CARBON 13/ISOTOPE EFFECTS**
Gas phase $^{13}C$ chemical shifts and coupling constants in the deuteromethanes, 3:22309
**CARBON 13 TARGET/PION MINUS REACTIONS**
Definitive test of outgoing-nucleon analog charge exchange using the reactions $^{12}C(\pi^{+-}\ {}^{12}C$(4.44 and 15.11 MeV), 3:22355
**CARBON 13 TARGET/PION PLUS REACTIONS**
Definitive test of outgoing-nucleon analog charge exchange using the reactions $^{12}C(\pi^{+-}\ {}^{12}C$(4.44 and 15.11 MeV), 3:22355
**CARBON 14/ISOTOPE EFFECTS**
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules, 3:21985 (N-77-26240)
**CARBON DIOXIDE/ATOM-MOLECULE COLLISIONS**
Quasiclassical trajectory study of the energy transfer in $CO_2$-rare gas systems, 3:22319
**CARBON DIOXIDE/BIOLOGICAL EFFECTS**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**CARBON DIOXIDE/DEMAND FACTORS**
Supply of carbon dioxide for enhanced oil recovery. Final report, October 15, 1976-September 1, 1977, 3:20953 (FE-2515-10)
**CARBON DIOXIDE/ENVIRONMENTAL EFFECTS**
Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4-6, 1977, 3:20936 (NP-22802)
**CARBON DIOXIDE/GEOLOGICAL SURVEYS**
Caroline carbon dioxide field and associated carbon dioxide occurrences, gambier embayment, south australia, 3:21063
**CARBON DIOXIDE/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**CARBON DIOXIDE/REMOVAL**
Fundamentals of gas treating, 3:21071 (CONF-7603113-)
Selective hydrogen sulfide removal, 3:21075 (CONF-7603113-)
**CARBON DIOXIDE ACCEPTOR PROCESS/SIMULATION**
Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1-November 30, 1976, 3:20860 (MIT-2295T9-2)
**CARBON DIOXIDE COOLED REACTORS**
*See also AGR TYPE REACTORS*
**CARBON DIOXIDE COOLED REACTORS/DISPLACEMENT GAGES**
Displacement measurements at high temperatures with capacitive transducers, 3:21577
**CARBON DIOXIDE LASERS/EFFICIENCY**
Efficient high energy infrared third harmonic generation in gases and liquids for laser fusion applications. Quarterly progress report, September 1, 1977-November 30, 1977, 3:22019 (COO-4251-4)
Efficient third harmonic generation of $CO_2$ laser radiation in liquid $CO$-$O_2$-$SF_6$ mixtures, 3:22637 (COO-4251-5)
**CARBON DIOXIDE LASERS/EXCITATION**
Electron-beam-controlled laser with a grid-controlled electron gun, 3:22055
**CARBON DIOXIDE LASERS/FREQUENCY CONVERTERS**
Infrared four-wave sum and difference frequency generation in liquid $CO$-$O_2$ mixtures, 3:22032

**CARBON DIOXIDE LASERS/MODULATION**
High-intensity transmission characteristics of $CH_3$-$CHF_2$ and CHFCHF, 3:22027
**CARBON DIOXIDE LASERS/SPECIFICATIONS**
Laser design considerations for an inertially confined fusion reactor, 3:22666
**CARBON DIOXIDE LASERS/STIMULATED EMISSION**
Dynamics of stimulated emission from an electron-beam-controlled $CO_2$ laser with a plasma mirror, 3:22044
**CARBON MONOXIDE/ADSORPTION**
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL-6906)
**CARBON MONOXIDE/AIR POLLUTION ABATEMENT**
Experimental study on the emissions of a model gas turbine combustor, 3:21866
**CARBON MONOXIDE/METHANATION**
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data, 3:20870
**CARBON MONOXIDE/MICROANALYSIS**
Sensitive optoacoustic detection of carbon monoxide by resonance absorption, 3:22150
**CARBON MONOXIDE/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
**CARBON MONOXIDE/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**CARBON MONOXIDE/REMOVAL**
Process for separation and recovery of carbon monoxide (Patent), 3:22094
**CARBON MONOXIDE/SYNTHESIS**
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
**CARBON MONOXIDE LASERS/MATHEMATICAL MODELS**
Gas-discharge CO laser with a high specific output energy, 3:22054
**CARBON MONOXIDE LASERS/PERFORMANCE TESTING**
Gas-discharge CO laser with a high specific output energy, 3:22054
Gasdynamic laser using a CO-Ar mixture, 3:22047
**CARBON STEELS/ABRASION**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CARBON STEELS/CORROSION**
Concerning a relation in piston compressor thermodynamics, 3:21560
**CARBON STEELS/CORROSION RESISTANCE**
Operating experience with amine absorber level control valves, 3:21076 (CONF-7603113-)
**CARBON STEELS/MICROSTRUCTURE**
Metallographic and chemical analyses of a plain carbon steel plate after long term service in a coal gasifier, 3:20871
**CARBON STEELS/WEAR**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CARBON TETRAFLUORIDE/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**CARBONYLS/ION CYCLOTRON RESONANCE SPECTROSCOPY**
Negative ion chemistry of (eta$^5$-$C_5H_5$)Co(CO)$_2$ in the gas phase by ion cyclotron resonance spectroscopy. The $\pi$-acceptor ability of $PF_3$ compared to CO, 3:21950
**CARBOXYLIC ACIDS/ELECTRON SPIN RESONANCE**
Electron spin resonance study of liquids during photolysis. XXII. The 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions, 3:21990
**CARBOXYLIC ACIDS/PHOTOLYSIS**
Electron spin resonance study of liquids during photolysis. XXII. The 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions, 3:21990
**CARCINOGENESIS/DOSE-RESPONSE RELATIONSHIPS**
Exposure to radon daughters and the incidence of lung cancer, 3:22256
**CARCINOMAS/CYTOLOGY**
Impulse cytophotometric and repeated cytologic examinations of cervical secretions as compared with histologic findings, 3:22235 (LA-tr-77-87)
**CARDIOVASCULAR DISEASES**
*See also MYOCARDIAL INFARCTION*
**CARDIOVASCULAR DISEASES/EPIDEMIOLOGY**
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22246
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247
**CARDIOVASCULAR DISEASES/RISK ASSESSMENT**
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247
**CASKS/LEAKS**
Study of plutonium oxide leak rates from shipping containers. Quarterly progress report, April 1, 1977-June 30, 1977, 3:22013 (BNWL-2260-3)
**CASKS/SAFETY**
Safety Analysis Report for Packaging (SARP): USA/9507/BLF (ERDA-AL), Model AL-M1 (Configurations 1, 3, and 5), 3:22012 (MLM-2447)
**CAST IRON/ABRASION**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CAST IRON/WEAR**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CATALYSTS/CHEMICAL PREPARATION**
Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976-July 31, 1977 (Sodium-graphite ($C_{64}Na$); potassium-graphite ($C_8K$); iron-graphite (potassium-reduced); iron-graphite (Sodium Aryl reducer)), 3:20858 (FE-2467-4)
**CATALYSTS/COMPARATIVE EVALUATIONS**
Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976-July 31, 1977 (Sodium-graphite ($C_{64}Na$); potassium-graphite ($C_8K$); iron-graphite (potassium-reduced); iron-graphite (Sodium Aryl reducer)), 3:20858 (FE-2467-4)
**CATALYSTS/PARTICLE SIZE**
Aerodynamic method for monitoring particle size distribution of microbead catalysts, 3:20993
**CATALYSTS/PERFORMANCE**
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October-December 1976, 3:21257 (FE-2276-6)
**CATALYSTS/PRODUCTION**
Treatment of waste streams from catalyst manufacturing plants in refineries, 3:21015
**CATALYSTS/SERVICE LIFE**
Catalysts for upgrading coal-derived liquids. Quarterly report, June 9-September 8, 1977, 3:20878 (FE-2011-9)
**CATAPHORESIS**
*See ELECTROPHORESIS*
**CATHODES/CHEMICAL PREPARATION**
Electrochemical cell, 3:21673
**CATHODES/MATERIALS**
Electrochemical generator, 3:21675
**CAVES/ENVIRONMENT**
Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves, 3:22185 (HASL-325)
**CAVES/RADIATION MONITORING**
Radon levels and ventilation effects in underground enclosures (Radioactivity from $^{222}$Rn in air in Workman Mine and Carlsbad Caverns), 3:22184 (HASL-325)
**CAVES/RADIOACTIVITY**
Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves, 3:22185 (HASL-325)
**CE ENTRAINED FUEL PROCESS/ENGINEERING**
Engineering review and evaluation of Combustion Engineering, Inc., coal gasification process development unit. Final report, 3:20853 (EPRI-AF-558)
**CE ENTRAINED FUEL PROCESS/PROCESS DEVELOPMENT UNITS**
Engineering review and evaluation of Combustion Engineering, Inc., coal gasification process development unit. Final report, 3:20853 (EPRI-AF-558)
**CELL FLOW SYSTEMS**
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr-77-86)
**CELL NUCLEI/FLUORESCENCE**
Impulse cytophotometric studies on tumor material, 3:22234 (LA-tr-77-88)
**CELLS (ANIMAL)**
*See ANIMAL CELLS*
**CELLS (BACTERIAL)**
*See BACTERIA*
**CELLS (ELECTROLYTIC)**
*See ELECTROLYTIC CELLS*

**CEMENTS/PHYSICAL PROPERTIES**
Borehole cement and rock properties studies: progress report, October 1, 1976-September 30, 1977, 3:21190 (Y/OWI/SUB-4091/6)
**CENTRAL RECEIVERS/CALCULATION METHODS**
Tower-type solar power plant: configuration and thermal-regime stability of receivers and steam generators, 3:21322
**CENTRAL RECEIVERS/DESIGN**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem (10-MW Pilot Plant and 100-MW Commercial Plant), 3:21320 (SAN/1108-8/4)
**CENTRAL RECEIVERS/PERFORMANCE TESTING**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem (10-MW Pilot Plant and 100-MW Commercial Plant), 3:21320 (SAN/1108-8/4)
**CERAMICS/MATERIALS TESTING**
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL-2004-6)
**CERAMICS/MECHANICAL PROPERTIES**
Coal gasification valves, Phase II. Quarterly technical progress report, June 1977-August 1977 (High temperature), 3:20856 (FE-2355-2(Rev.D))
**CERIUM/SELF-DIFFUSION**
Anomalous self-diffusion in rare earths and actinides, 3:21892
**CERIUM 129/HIGH SPIN STATES**
Hsub(11/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce, 3:22362
**CERIUM 131/HIGH SPIN STATES**
Hsub(11/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce, 3:22362
**CERIUM 144/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**CERIUM 144/RADIATION MONITORING**
High altitude balloon sampling program (Fallout monitoring), 3:22157 (EML-334)
**CERIUM 144/RADIOMETRIC ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**CERIUM OXIDES/CHEMICAL REACTIONS**
Reactions between SiC and Pd or $CeO_2$ at high temperatures (HTGR fuel particles), 3:21576
**CESIUM/ADSORPTION**
Use of natural Uzbekistan zeolites for purification of low-level liquid waste. I. Sorption of radioactive cesium, 3:21178
**CESIUM/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**CESIUM 128/BETA-PLUS DECAY**
Decay of $^{128}$Cs, 3:22359 (TREE-1115)
**CESIUM 128/ENERGY-LEVEL TRANSITIONS**
Decay of $^{128}$Cs, 3:22359 (TREE-1115)
**CESIUM 134/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**CESIUM 137/ENVIRONMENTAL TRANSPORT**
Cesium-137 in various Chicago foods (collection month: October 1977), 3:22204 (EML-334)
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**CESIUM 137/RADIATION MONITORING**
High altitude balloon sampling program (Fallout monitoring), 3:22157 (EML-334)
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**CESIUM 137/RADIOECOLOGICAL CONCENTRATION**
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**CESIUM 137/RADIOMETRIC ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**CESIUM COMPOUNDS/MOESSBAUER EFFECT**
Paramagnetic spin relaxation in $Cs_2NaYbCl_6$, 3:21969
**CESIUM COMPOUNDS/RADIATION SCATTERING ANALYSIS**
X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts, 3:21935
**CHARCOAL/COMBUSTION**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**CHARM PARTICLES**
*See also D RESONANCES*
**CHARM PARTICLES/PARTICLE PRODUCTION**
Production of charmed particles in weak interactions with diagonal neutral currents, 3:22345
Psionic matter, 3:22349
**CHARS/CHEMICAL REACTION KINETICS**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
**CHARS/DESULFURIZATION**
Method for desulfurizing char by acid washing and treatment with hydrogen gas (Patent), 3:20847
**CHARS/HEAT TREATMENTS**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
**CHEMICAL ANALYSIS**
*See also ACTIVATION ANALYSIS*
*FLUORESCENCE SPECTROSCOPY*
*MULTI-ELEMENT ANALYSIS*
*NUCLEAR REACTION ANALYSIS*
*RADIOMETRIC ANALYSIS*
*X-RAY FLUORESCENCE ANALYSIS*
**CHEMICAL ANALYSIS/RESEARCH PROGRAMS**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**CHEMICAL EFFLUENTS/ENVIRONMENTAL IMPACTS**
Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants, 3:22196
**CHEMICAL EFFLUENTS/ENVIRONMENTAL TRANSPORT**
Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis (Environmental pollution during fossil fuel combustion), 3:22276 (EML-334)
Environmental Measurements Laboratory environmental quarterly, September 1-December 1, 1977, 3:22152 (EML-334)
Suspended particulates and natural radionuclides as tracers of pollutant transports in Continental Shelf waters of the Eastern U.S.A. ($^{222}$Rn tracer), 3:22215 (TID-22790)
**CHEMICAL EFFLUENTS/MATHEMATICAL MODELS**
ENFORM fuel cycle effluents model, 3:21204
**CHEMICAL EXPLOSIVES**
*See also TATB*
**CHEMICAL EXPLOSIVES/IGNITION**
Thermal ignition time for homogeneous explosives involving two parallel reactions, 3:22136
**CHEMICAL EXPLOSIVES/SAFETY**
Quality assurance plan. Site 300 chemistry high explosives facilities, 3:22132 (M-078-02)
**CHEMICAL EXPLOSIVES/TENSILE PROPERTIES**
Mechanical properties of LX-10-1. Process Development Endeavor No. 105, 3:22134 (MHSMP-77-58)
**CHEMICAL FEEDSTOCKS**
*See also PETROCHEMICALS*
**CHEMICAL FEEDSTOCKS/PRODUCTION**
Proposal to utilize fusion reactor energy sources for chemical process applications, 3:21248 (UCID-17590)
**CHEMICAL INDUSTRY**
*See also MINERAL INDUSTRY*
**CHEMICAL INDUSTRY/ENERGY CONSUMPTION**
Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 1. Draft target and support document, 3:21823 (PB-269869)
Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 2. Appendixes Part 1. Draft target and support document, 3:21824 (PB-269870)
Developing a maximum energy efficiency improvement target for sic 28: chemicals and allied products. Volume 3. Appendixes part 2. Draft target and support document, 3:21825 (PB-269871)
Developing a maximum energy efficiency improvement target for SIC 28: chemicals and allied products. Volume 4. Revisions and addenda. Draft target and support document, 3:21826 (PB-269872)
Developing a maximum energy efficiency target for SIC 28: chemicals and allied products. Volume 5. Further revisions. Draft target and support document, 3:21827 (PB-269873)
Developing a maximum energy efficiency target for SIC 28: chemicals and allied products. Volume 6, 3:21828 (PB-269874)
**CHEMICAL INDUSTRY/POLLUTION CONTROL EQUIPMENT**
Costly business of purifying noxious emissions, 3:22093
**CHEMICAL REACTIONS**
*See also CHEMISORPTION*
*FISCHER-TROPSCH SYNTHESIS*
*PHOTOCHEMICAL REACTIONS*
*PHOTOSYNTHESIS*
**CHEMICAL REACTIONS/MATHEMATICAL MODELS**
Modeling complex chemical reactions in flows with turbulent, diffusive mixing, 3:22068 (UCRL-79770)
**CHEMICAL REACTORS**
*See also RETORTS*
**CHEMICAL REACTORS/DESIGN**
Methane gas process and apparatus (Patent), 3:21260

**CHEMICAL REACTORS/EXPLOSIONS**
Explosion and fire during conversion of liquid uranyl nitrate to solid uranium oxide, 3:21212
**CHEMICAL REACTORS/FIRES**
Explosion and fire during conversion of liquid uranyl nitrate to solid uranium oxide, 3:21212
**CHEMICAL REACTORS/MATHEMATICAL MODELS**
Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977-March 31, 1977, 3:20854 (FE-1770-26)
**CHEMISORPTION**
*(Dissolution or adsorption followed by chemical reaction.)*
Coordination chemistry guide to structural studies of chemisorbed molecules, 3:21953
**CHEST/BLOOD FLOW**
Blood flow imaging with nuclear magnetic resonance, 3:22242
**CHICAGO/RADIATION MONITORING**
Cesium-137 in various Chicago foods (collection month: October 1977), 3:22204 (EML-334)
**CHINA/NUCLEAR EXPLOSIONS**
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**CHIRAL SYMMETRY/SYMMETRY BREAKING**
Chiral symmetry breaking and the quark model: unification of baryon and meson constraints (Review), 3:22352
**CHLORINATED ALIPHATIC HYDROCARBONS/ELECTRONIC STRUCTURE**
Structure and energetics of simple carbenes $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$, 3:21981
**CHLORINATED ALIPHATIC HYDROCARBONS/TOXICITY**
Trichloroethylene. I. An overview, 3:21984
**CHLORINE COMPOUNDS/MOESSBAUER EFFECT**
Paramagnetic spin relaxation in $Cs_2NaYbCl_6$, 3:21969
**CHLORINE FLUORIDES/MOLECULAR STRUCTURE**
Chemical applications of molecular quantum theory, 3:21947 (LBL-6699)
**CHLORINE IONS/MOLECULAR STRUCTURE**
Chemical applications of molecular quantum theory, 3:21947 (LBL-6699)
**CHLOROFORM/TOXICITY**
Differential toxicity of chloroform in the mouse, 3:22278
**CHORIOALLANTOIC MEMBRANE**
*See FETAL MEMBRANES*
**CHROMIUM/COMPRESSIBILITY**
Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**CHROMIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**CHROMIUM ALLOYS**
*See also CHROMIUM BASE ALLOYS*
*CHROMIUM STEELS*
*NICKEL-CHROMIUM STEELS*
*STAINLESS STEELS*
**CHROMIUM ALLOYS/FATIGUE**
Evaluation of the fatigue resistance of CDA 182 copper for use in the impurity study experiment fusion research tokamak (ISX) (CDA 182 copper), 3:22682 (ORNL-5302)
**CHROMIUM BASE ALLOYS/DEPOSITION**
Wear resistant coatings for titanium alloys. Final report 15 March 1976-15 March 1977 (Cr-Mo coating on Ti-8Al-1V-1Mo substrate), 3:21872 (AD-A-042443)
**CHROMIUM COMPLEXES/CHEMICAL REACTION KINETICS**
Trans effects in octahedral complexes: substitution of chloromethyl- and dichloromethylpentaaquochromium(III) ions by thiocyanate ion, 3:21957
**CHROMIUM COMPLEXES/OXIDATION**
Reaction of fluorine and hypofluorous acid with some substitution-inert complex ions in aqueous perchloric acid solutions, 3:21959
**CHROMIUM COMPLEXES/STRUCTURAL CHEMICAL ANALYSIS**
Moessbauer spectra of Np(V)-Cr(III) and Np(V)-Rh(III) complexes, 3:21962
**CHROMIUM COMPOUNDS/EMISSION SPECTROSCOPY**
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T-741)
**CHROMIUM OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**CHROMIUM STEELS**
*(Steels containing only chromium as alloying element; see also CHROMIUM-NICKEL STEELS.)*
**CHROMIUM STEELS/ABRASION**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CHROMIUM STEELS/WEAR**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CHROMIUM-MOLYBDENUM STEELS/ABRASION**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CHROMIUM-MOLYBDENUM STEELS/MECHANICAL PROPERTIES**
Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976-30 September 1977, 3:20879 (IS-4310)
Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April-30 June 1977, 3:20880 (IS-4311)
**CHROMIUM-MOLYBDENUM STEELS/THERMAL EXPANSION**
Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976-30 September 1977, 3:20879 (IS-4310)
Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April-30 June 1977, 3:20880 (IS-4311)
**CHROMIUM-MOLYBDENUM STEELS/WEAR**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**CHROMOSOMES/DATA ANALYSIS**
Characterization of malignant ovarian tumors by impulse cytophotometry, 3:22236 (LA-tr-77-94)
**CIRCUIT BREAKERS/ELECTRIC ARCS**
Modeling of arc discharges in power circuit breakers. Final report, 3:21529 (EPRI-EL-482)
**CLAMS**
*See MOLLUSCS*
**CLATHRATES/CATALYTIC EFFECTS**
Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976-July 31, 1977, 3:20858 (FE-2467-4)
**CLINCH RIVER BREEDER REACTOR/FUEL CANS**
Clinch River Breeder Reactor Plant. Internal/external cladding degradation, 3:21581 (CRBRP-ARD-0147)
**CLINCH RIVER BREEDER REACTOR/LEAK DETECTORS**
Leak detection system design and operating considerations for the US-CRBRP, 3:21578 (CONF-760735-1)
**CLINCH RIVER BREEDER REACTOR/PRIMARY COOLANT CIRCUITS**
Clinch River Breeder Reactor Plant. Effects of thermal aging on CRBRP primary piping, 3:21582 (CRBRP-ARD-0188)
**CLINCH RIVER BREEDER REACTOR/REACTOR COMPONENTS**
Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME-77-38)
**CLINCH RIVER BREEDER REACTOR/REACTOR COOLING SYSTEMS**
Clinch River Breeder Reactor Plant. Integrity of primary and intermediate heat transport system piping in containment, 3:21635 (CRBRP-ARD-0185(Vol.1))
**CLINCH RIVER BREEDER REACTOR/SECONDARY COOLANT CIRCUITS**
Leak detection system design and operating considerations for the US-CRBRP, 3:21578 (CONF-760735-1)
**CLINCH RIVER BREEDER REACTOR/STEAM GENERATORS**
Disc-Donut-Tube wear test report, Phase I, 3:21588 (TID-27816)
**CLINTON P ANDERSON MESON PHY. FACILITY**
*See LAMPF LINAC*
**CLUSTER EMISSION MODEL/ELECTRON-POSITRON INTERACTIONS**
Single-cluster descriptions of jets in $e^+e^-$ annihilation (Decay matrix element, spin-one cluster), 3:22344
**COAL**
*See also ANTHRACITE*
*BITUMINOUS COAL*
*COAL GASIFICATION*
*COAL LIQUEFACTION*
*LIGNITE*
*SOLVENT-REFINED COAL*
**COAL/ACTIVATION ANALYSIS**
Application of neutron activation analysis to coal research, 3:21919
Fast-neutron activation analysis in coal research, 3:21921
Neutron induced gamma spectrometry for on-line compositional analysis in coal conversion and fluidized-bed combustion plants, 3:20887 (CONF-771072-3)
System optimization for prompt-neutron activation analysis of coal, 3:21922
**COAL/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))

**COAL/AVAILABILITY**
Status of coal supply contracts for new electric generating units, 1976-1985, 3:21727 (TID-28066)
**COAL/CALORIFIC VALUE**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
Prediction model for compositional changes within a coal from core data. Quarterly report, September-December 1976, 3:20891 (FE-5065-2)
**COAL/CARBONIZATION**
Influence of charge moisture contents on carbonization periods, 3:20845
Pilot commercial carbonization of 50% gas-coal blends, 3:20844
**COAL/CHARGES**
Coal: bituminous and lignite in 1975, 3:20932
**COAL/CHEMICAL ANALYSIS**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
Material balance in coal. 2. Oxygen determination and stoichiometry of 33 coals, 3:20888 (COO-2898-10)
Petrographic method for selective determination of a component (raw coal) in a mixture of products from processing of coal, 3:20850 (CONF-780305-1)
**COAL/CHEMICAL COMPOSITION**
Coal minerals bibliography. Quarterly report No. 1, June 15-September 15, 1977, 3:20892 (FE/2692-1)
Prediction model for compositional changes within a coal from core data. Quarterly report, September-December 1976, 3:20891 (FE-5065-2)
**COAL/COMBUSTION**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
Chemical equilibrium in ash-laden coal combustion systems, 3:20890 (FE-2205-7)
Direct sampling and characterization of gaseous species responsible for fireside corrosion in fossil fuel-fired systems. Fourth quarterly progress report, January 1-March 31, 1977, 3:20928 (FE-2288-16)
Fossil energy research meeting, 3:20841 (CONF-7706100-)
Investigation of the behavior of the mineral matter of acid composition in high temperature combustion of coal, 3:20930
Principal aspects of converting steam generators back to coal, 3:21810 (CONF-770658-)
**COAL/COMBUSTION KINETICS**
Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976-February 28, 1977, 3:21754 (FE-2215-7)
Development program for MHD power generation. Quarterly report, April 1976-June 1976, 3:21752 (FE-2015-12)
Development program for MHD power generation. Quarterly report, October 1976-December 1976, 3:21753 (FE-2015-21)
**COAL/COMBUSTION PRODUCTS**
Environmental overview, 3:20910 (CONF-770658-)
**COAL/COMBUSTION PROPERTIES**
Blast furnace coal injection at Armco's Ashland Works, 3:21809 (CONF-770658-)
Experiences in direct firing of glass furnaces, Columbine Glass, 3:21808 (CONF-770658-)
General Motors powdered coal-oil project, 3:20925 (CONF-770658-)
Pittsburgh Energy Research Center (PERC) combustion support program, 3:20926 (CONF-770658-)
**COAL/CONTRACTS**
Status of coal supply contracts for new electric generating units, 1976-1985, 3:21727 (TID-28066)
**COAL/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**COAL/DESULFURIZATION**
Desulfurization of various midwestern coals by flotation, 3:20918 (BM-RI-8262)
**COAL/ENVIRONMENTAL EFFECTS**
Environmental overview, 3:20910 (CONF-770658-)
**COAL/FLOTATION**
Desulfurization of various midwestern coals by flotation, 3:20918 (BM-RI-8262)
Quality characteristics and floatability of Pechora coals, 3:20920
Use of methylisobutylcarbinol for coal flotation, 3:20921
**COAL/FLUIDIZED-BED COMBUSTION**
Analysis of the high-temperature particulate collection problem, 3:20922 (ANL-77-14)
Coal fired combined cycle for electric power generation, 3:21482 (TID-27939)
Coal is the only solution, 3:21464
Preliminary environmental assessment of coal-fired fluidized-bed combustion systems. Preliminary report September 1975-June 1976, 3:20929 (PB-269556)
Pressurized fluidized bed combustion. Quarterly technical progress report, January-March 1977, 3:20927 (FE-1511-39)
**COAL/HYDROGENATION**
Early coal hydrogenation catalysis, 3:20883
Residence time measurements in a coal hydrogenation process, 3:20848
Riser cracking of coal to oil and gas (2000 psig; 1400 to 1500°F), 3:20875 (CONF-770814-10)
**COAL/INFORMATION SYSTEMS**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
**COAL/MECHANICAL PROPERTIES**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**COAL/MEETINGS**
Proceedings of the fuel switching forum, 3:20924 (CONF-770658-)
**COAL/MOISTURE**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
**COAL/PETROLOGY**
Prediction model for compositional changes within a coal from core data. Quarterly report, September-December 1976, 3:20891 (FE-5065-2)
**COAL/PRODUCTION**
Coal: bituminous and lignite in 1975, 3:20932
**COAL/PYROLYSIS**
Residence time measurements in a coal hydrogenation process, 3:20848
Riser cracking of coal to oil and gas (2000 psig; 1400 to 1500°F), 3:20875 (CONF-770814-10)
**COAL/SAMPLING**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**COAL/SOLVOLYSIS**
Solvolysis extraction using quinoline and phenol resin as coal model, 3:20885
**COAL/STORAGE**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
**COAL/SURFACE PROPERTIES**
Quality characteristics and floatability of Pechora coals, 3:20920
**COAL/TRANSPORT**
Coal supply and transportation overview, 3:20931 (CONF-770658-)
**COAL/X-RAY FLUORESCENCE ANALYSIS**
Method and device for determining the sulfur content of coal (Patent), 3:20897
**COAL DEPOSITS/EXPLORATION**
Mineral exploration and mining in Brasil--1977, 3:20915
**COAL DEPOSITS/GEOCHEMISTRY**
Distribution of clark uranium in terrigenous strata of Lower Carbonic period in the limits of the Orenburg region, 3:21116
**COAL DEPOSITS/SAMPLING**
Prediction model for compositional changes within a coal from core data. Quarterly report, September-December 1976, 3:20891 (FE-5065-2)
**COAL FINES/SEPARATION PROCESSES**
Optimum conditions for the fractional analysis of <1 mm coal samples, 3:20898
**COAL FINES/USES**
Reciprocating internal combustion engine for operation with fuel in powder form (Patent), 3:21861
**COAL GAS/CLEANING**
Processing of coke furnace gas. Separation of naphthalene, 3:20886
**COAL GAS/CORROSIVE EFFECTS**
Metallographic and chemical analyses of a plain carbon steel plate after long term service in a coal gasifier, 3:20871
**COAL GASIFICATION**
*See also CARBON DIOXIDE ACCEPTOR PROCESS*
*HYGAS PROCESS*
*IN-SITU GASIFICATION*
*SYNTHANE PROCESS*
Development trends in coal gasification, 3:20866
Gasification as a first step to using coal as a fuel and raw material, 3:20868
**COAL GASIFICATION/COMMERCIALIZATION**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE-2343-45)

**COAL GASIFICATION/COMPUTER-AIDED DESIGN**
Computer-aided industrial process design: the ASPEN project. First quarterly progress report, June 1-August 31, 1976, 3:20859 (MIT-2295T9-1)
**COAL GASIFICATION/ENTRAINMENT**
Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977-March 31, 1977, 3:20854 (FE-1770-26)
**COAL GASIFICATION/ENVIRONMENTAL IMPACTS**
Water conservation and pollution control in coal conversion processes. Final report June 1975-December 1976, 3:20913 (PB-269568)
**COAL GASIFICATION/FEASIBILITY STUDIES**
Electrofluid gasification of coal with nuclear energy (Process heat supplied by thermal and/or electric coupling), 3:20864
**COAL GASIFICATION/FLUIDIZED BED**
Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977-March 31, 1977, 3:20854 (FE-1770-26)
**COAL GASIFICATION/SIMULATION**
Computer-aided industrial process design: the ASPEN project. First quarterly progress report, June 1-August 31, 1976, 3:20859 (MIT-2295T9-1)
**COAL GASIFICATION/TECHNOLOGY ASSESSMENT**
Coal gasification: when, 3:20851 (CONF-7603113-)
**COAL GASIFICATION/WATER REQUIREMENTS**
Water conservation and pollution control in coal conversion processes. Final report June 1975-December 1976, 3:20913 (PB-269568)
**COAL GASIFICATION PLANTS/COMPUTER-AIDED DESIGN**
Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1-November 30, 1976, 3:20860 (MIT-2295T9-2)
**COAL GASIFICATION PLANTS/DECISION MAKING**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE-2343-45)
**COAL GASIFICATION PLANTS/ECONOMICS**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE-2343-45)
**COAL GASIFICATION PLANTS/ENVIRONMENTAL IMPACT STATEMENTS**
Alternative Fuels Demonstration Program. Final environmental impact statement, 3:20912 (ERDA-1547(Vol.2))
**COAL GASIFICATION PLANTS/ENVIRONMENTAL IMPACTS**
Evaluation of background data relating to new source performance standards for Lurgi gasification. Final report September 1976-February 1977, 3:20861 (PB-269557)
**COAL GASIFICATION PLANTS/FORECASTING**
Coal gasification: when, 3:20851 (CONF-7603113-)
**COAL GASIFICATION PLANTS/FUEL FEEDING SYSTEMS**
Coal pump development and technical support. Quarterly project report. Report No. 2, 3:20852 (DOE/JPL/2616-2)
**COAL GASIFICATION PLANTS/MATERIALS**
Metallographic and chemical analyses of a plain carbon steel plate after long term service in a coal gasifier, 3:20871
**COAL GASIFICATION PLANTS/MATHEMATICAL MODELS**
Computer modeling of coal gasification reactors. Quarterly technical progress report, January 1, 1977-March 31, 1977, 3:20854 (FE-1770-26)
**COAL GASIFICATION PLANTS/PROCESS CONTROL**
Beryllium-reflected coal analytical assembly using $^{252}Cf$ neutron-capture gamma rays, 3:21924
**COAL GASIFICATION PLANTS/SCALING LAWS**
Scaling laws and the differential equations of an entrained flow coal gasifier, 3:20863
**COAL GASIFICATION PLANTS/SIMULATION**
Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1-November 30, 1976, 3:20860 (MIT-2295T9-2)
**COAL GASIFICATION PLANTS/SWIRL FLOW**
Scaling laws and the differential equations of an entrained flow coal gasifier, 3:20863
**COAL GASIFICATION PLANTS/VALVES**
Coal gasification valves, Phase II. Quarterly technical progress report, June 1977-August 1977 (High temperature), 3:20856 (FE-2355-2(Rev.D))
Report of survey of valve industry capabilities, 3:20849 (CONF-771145-2)
**COAL GASIFICATION PLANTS/WELDED JOINTS**
Factors affecting the corrosion of fusion-welded joints in coal gasification systems, 3:20872
**COAL INDUSTRY**
*See also MINERAL INDUSTRY*
**COAL INDUSTRY/EQUIPMENT**
Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976-August 1977, 3:20840 (FE-2479-1)
**COAL INDUSTRY/MEETINGS**
Rocky Mountain Coal Mining Institute. 72nd regular meeting, 3:21725 (CONF-7606160-)
**COAL INDUSTRY/STATISTICS**
Mining within the energy economy of the Federal Republic in 1975, 3:20933
**COAL LIQUEFACTION/CATALYSTS**
Early coal hydrogenation catalysis, 3:20883
**COAL LIQUEFACTION/COMMERCIALIZATION**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE-2343-45)
**COAL LIQUEFACTION/SYNTHESIS GAS**
Coal liquefaction and desulfurization, utilizing synthesis gas (Patent), 3:20884
**COAL LIQUEFACTION PLANTS/DECISION MAKING**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE-2343-45)
**COAL LIQUEFACTION PLANTS/ECONOMICS**
Cash flow analysis of alternative approaches to commercialization of coal conversion technologies, 3:21726 (FE-2343-45)
**COAL LIQUEFACTION PLANTS/ENVIRONMENTAL IMPACT STATEMENTS**
Alternative Fuels Demonstration Program. Final environmental impact statement, 3:20912 (ERDA-1547(Vol.2))
**COAL LIQUEFACTION PLANTS/MATERIALS TESTING**
Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976-30 September 1977, 3:20879 (IS-4310)
Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April-30 June 1977, 3:20880 (IS-4311)
**COAL LIQUEFACTION PLANTS/PROCESS CONTROL**
Beryllium-reflected coal analytical assembly using $^{252}Cf$ neutron-capture gamma rays, 3:21924
**COAL LIQUEFACTION PLANTS/VALVES**
Report of survey of valve industry capabilities, 3:20849 (CONF-771145-2)
**COAL LIQUIDS/CHEMICAL COMPOSITION**
Nitrogen compounds in coal derived liquids, 3:20894
**COAL LIQUIDS/HYDROCRACKING**
Catalytic activities and selectivities of $MoO_3$-$NiSO_4$ supported on various oxides for hydrocracking of solvent refined lignite. Novel low surface area active catalysts, 3:20881
**COAL LIQUIDS/MASS SPECTROSCOPY**
Mass spectrometric analytical services and research activities to support coal-liquid characterization research. Quarterly report, June 9-September 30, 1977, 3:20874 (BERC-0020-9)
**COAL LIQUIDS/REFINING**
Catalysts for upgrading coal-derived liquids. Quarterly report, June 9-September 8, 1977 (Rasyn oil; 700°F; 1500 psig), 3:20878 (FE-2011-9)
**COAL MINERS/INSURANCE**
Program to pay black lung benefits to coal miners and their survivors: improvements are needed. Departments of Labor and Health, Education, and Welfare, 3:21689 (PB-269875)
**COAL MINERS/WORKMENS COMPENSATION**
Program to pay black lung benefits to coal miners and their survivors: improvements are needed. Departments of Labor and Health, Education, and Welfare, 3:21689 (PB-269875)
**COAL MINES/OWNERSHIP**
Electric utilities captive coal operations, 3:21741 (PB-269348)
**COAL MINES/ROOFS**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**COAL MINES/SUPPORTS**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**COAL MINING**
*See also ACID MINE DRAINAGE*
*LONGWALL MINING*
*SURFACE MINING*
*UNDERGROUND MINING*
Nuclear techniques in exploration, extraction and processing of mineral resources. Report on the international symposium held in Vienna from 7 to 10 March 1977, 3:20942
**COAL MINING/ENVIRONMENTAL IMPACTS**
Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4-6, 1977, 3:20936 (NP-22802)
**COAL MINING/FORECASTING**
Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4-6, 1977, 3:20936 (NP-22802)
**COAL MINING/RESEARCH PROGRAMS**
Bureau of Mines research 1976: a summary of significant results in mining, metallurgy, and mineral economics, 3:21697

**COAL MINING/SOCIO-ECONOMIC FACTORS**
Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4-6, 1977, 3:20936 (NP-22802)
**COAL PREPARATION/EFFICIENCY**
Determining the efficiency of p.f. preparation under conditions of varying load of a generating unit, 3:20919
**COAL RESERVES**
Coal supply and transportation overview, 3:20931 (CONF-770658-)
**COAL-DERIVED LIQUIDS**
*See COAL LIQUIDS*
**COAL-FIRED MHD GENERATORS/ELECTRICAL INSULATORS**
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL-2004-6)
**COAL-FIRED MHD GENERATORS/ELECTRODES**
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL-2004-6)
**COAL-FIRED MHD GENERATORS/FLUID FLOW**
Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976-February 28, 1977, 3:21754 (FE-2215-7)
**COAL-FIRED MHD GENERATORS/MATERIALS TESTING**
Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976-February 28, 1977, 3:21754 (FE-2215-7)
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL-2004-6)
**COAL-FIRED MHD GENERATORS/MATHEMATICAL MODELS**
Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976-February 28, 1977, 3:21754 (FE-2215-7)
**COAL-FIRED MHD GENERATORS/PERFORMANCE TESTING**
Development program for MHD power generation. Quarterly report, April 1976-June 1976, 3:21752 (FE-2015-12)
Development program for MHD power generation. Quarterly report, October 1976-December 1976, 3:21753 (FE-2015-21)
**COAL-FIRED MHD GENERATORS/RESEARCH PROGRAMS**
Critical contributions in MHD power generation. Quarterly technical progress report, December 1, 1976-February 28, 1977, 3:21754 (FE-2215-7)
Development program for MHD power generation. Quarterly report, April 1976-June 1976, 3:21752 (FE-2015-12)
Development program for MHD power generation. Quarterly report, October 1976-December 1976, 3:21753 (FE-2015-21)
**COAL-FIRED MHD GENERATORS/TEST FACILITIES**
CDIF-MHD generator system conceptual design, 3:21755 (TID-27152)
Development program for MHD power generation. Quarterly report, October 1976-December 1976, 3:21753 (FE-2015-21)
**COASTAL REGIONS/ENERGY FACILITIES**
Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report (State and Federal roles), 3:21684 (PB-271104)
**COASTAL REGIONS/POLLUTION**
Fate of a bunker fuel in beach sand, 3:22211 (CONF-730386-)
**COASTAL REGIONS/TERMINAL FACILITIES**
Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report (State and Federal roles), 3:21684 (PB-271104)
**COASTAL REGIONS/WATER POLLUTION**
Interagency investigations of a persistent oil spill on the Washington Coast, 3:22270 (CONF-730386-)
**COASTAL WATERS/WATER CURRENTS**
Currents along the Northwest African coast South of 22° North, 3:22288
**COASTAL WATERS/WATER POLLUTION**
Suspended particulates and natural radionuclides as tracers of pollutant transports in Continental Shelf waters of the Eastern U.S.A. ($^{222}Rn$ tracer), 3:22215 (TID-22790)
**COATED FUEL PARTICLES/FISSION PRODUCT RELEASE**
Behavior of fission product gases in HTGR fuel material, 3:21572 (GA-A-13723)
**COATED FUEL PARTICLES/PERFORMANCE TESTING**
Evaluation of BISO and TRISO coated $ThO_2$ fuel particles irradiated in HFIR capsules HT-12 through HT-15 and HT-17 through HT-19, 3:21571 (GA-A-13557)
**COATINGS/PERFORMANCE**
Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results, 3:21378
**COATINGS/REFLECTIVITY**
Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results, 3:21378
**COBALT/ACTIVATION ANALYSIS**
Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean, 3:21925
**COBALT COMPLEXES/CRYSTAL STRUCTURE**
Crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ and $Cd_3[Co(CN)_6]_2.12H_2O$ by neutron and x-ray diffraction, 3:21956
**COBALT COMPLEXES/ION CYCLOTRON RESONANCE SPECTROSCOPY**
Negative ion chemistry of (eta$^5$-$C_5H_5$)$Co(CO)_2$ in the gas phase by ion cyclotron resonance spectroscopy. The $\pi$-acceptor ability of $PF_3$ compared to CO, 3:21950
**COBALT OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**COKE/ACTIVATION ANALYSIS**
Fast-neutron activation analysis in coal research, 3:21921
**COKE/CHEMICAL REACTION YIELD**
Coke yield from the charge, 3:20843
**COKE/MECHANICAL PROPERTIES**
Pilot commercial carbonization of 50% gas-coal blends, 3:20844
**COKE/PHYSICAL PROPERTIES**
Pilot commercial carbonization of 50% gas-coal blends, 3:20844
**COKE/PRODUCTION**
Combination thermal cracking and coking process (Patent), 3:20997
**COKE OVENS/PERFORMANCE**
Coke-oven performance on coarsened charge, 3:20842
**COKE-OVEN GAS**
*See COAL GAS*
**COLD PLASMA/ELECTROMAGNETIC RADIATION**
Intense circularly polarized waves in plasmas, 3:22513
**COLD PLASMA/WHISTLERS**
Obliquely propagating whistler mode waves in cold plasmas permeated by dilute low-$\beta$ anisotropic plasmas, 3:22519
**COLLECTIVE ACCELERATORS/CRYOGENICS**
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**COLLECTIVE ACCELERATORS/SUPERCONDUCTING CAVITY RESONATORS**
Results of experiments on the rf superconducting accelerating section of the collective accelerator. II, 3:22108
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**COLLECTIVE ACCELERATORS/SUPERCONDUCTING COILS**
Results of experiments on the rf superconducting accelerating section of the collective accelerator. II, 3:22108
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**COLLIERIES**
*See COAL MINES*
**COLLISIONAL PLASMA/ELECTRON BEAM INJECTION**
Experiments on current-driven three-dimensional ion sound turbulence. Part I: Return-current limited electron beam injection, 3:22483
**COLLISIONAL PLASMA/HEAT FLOW**
Resonant absorption in plasma density profiles produced by laser heating, heat flow, and hydrodynamics, 3:22459
**COLLISIONAL PLASMA/ION WAVE INSTABILITY**
Experiments on current-driven three-dimensional ion sound turbulence. Part I: Return-current limited electron beam injection, 3:22483
**COLLISIONAL PLASMA/LASER RADIATION**
Resonant absorption in plasma density profiles produced by laser heating, heat flow, and hydrodynamics, 3:22459
**COLLISIONAL PLASMA/PLASMA SIMULATION**
Resonant absorption in plasma density profiles produced by laser heating, heat flow, and hydrodynamics, 3:22459
**COLLISIONAL PLASMA/TRANSPORT THEORY**
Neoclassical transport of a multi-species plasma in a mixed regime with several collisional species, 3:22460
**COLLISIONLESS PLASMA/DRIFT INSTABILITY**
Propagation of nonlinear electrostatic drift solitary waves in a collisionless plasma consisting of two ion species, 3:22502
Theory and numerical simulations on collisionless drift instabilities in three dimensions, 3:22477 (PPPL-1397)
**COLLISIONLESS PLASMA/ELECTRON BEAM INJECTION**
Experiments on current-driven three-dimensional ion sound turbulence. Part II: Wave dynamics, 3:22484
**COLLISIONLESS PLASMA/ION WAVE INSTABILITY**
Experiments on current-driven three-dimensional ion sound turbulence. Part II: Wave dynamics, 3:22484

**COLLISIONLESS PLASMA/PLASMA INSTABILITY**
Spatial growth of filamentation instability in a collisionless magnetoplasma, 3:22493
**COLLISIONLESS PLASMA/RANDOM PHASE APPROXIMATION**
Random phase wave: a soluble non-Markovian system, 3:22456 (PPPL-1401)
**COLONIES**
*See POPULATIONS*
**COLORADO/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**COLORADO/OIL SHALE DEPOSITS**
BX in situ oil shale project. Quarterly progress report No. 1, March 1-May 31, 1977, 3:21104 (TID-27970)
**COLORADO/RADIOACTIVE WASTE DISPOSAL**
Summary of the Phase II, Title I, engineering assessment of inactive uranium mill tailings, Gunnison Site, Gunnison, Colorado, 3:21201 (GJT-125)
**COLORADO/URANIUM DEPOSITS**
Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX-78(77))
**COLUMBIUM**
*See NIOBIUM*
**COMBINED-CYCLE POWER PLANTS/COST**
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N-77-26628)
**COMBINED-CYCLE POWER PLANTS/DESIGN**
Development of the combined gas-steam turbine power plants, 3:21483
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N-77-26628)
**COMBINED-CYCLE POWER PLANTS/ENVIRONMENTAL IMPACTS**
Water conservation and pollution control in coal conversion processes. Final report June 1975-December 1976, 3:20913 (PB-269568)
**COMBINED-CYCLE POWER PLANTS/OPERATION**
Coal fired combined cycle for electric power generation, 3:21482 (TID-27939)
**COMBINED-CYCLE POWER PLANTS/PERFORMANCE**
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N-77-26628)
**COMBINED-CYCLE POWER PLANTS/WASTE HEAT**
Combined gas/steam-turbine power station belonging to the Stadtwerke Saarbruecken AG, 3:21519
**COMBINED-CYCLE POWER PLANTS/WATER REQUIREMENTS**
Water conservation and pollution control in coal conversion processes. Final report June 1975-December 1976, 3:20913 (PB-269568)
**COMBUSTION**
*See also FLUIDIZED-BED COMBUSTION*
*IN-SITU COMBUSTION*
**COMBUSTION/RESEARCH PROGRAMS**
Pittsburgh Energy Research Center (PERC) combustion support program, 3:20926 (CONF-770658-)
**COMBUSTION CHAMBERS**
*See also COMBUSTORS*
**COMBUSTION CHAMBERS/DESIGN**
Investigation of the combustion chamber of an experimental MHD generator and some problems of updating, 3:21763
**COMBUSTION PRODUCTS/CORROSIVE EFFECTS**
Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils, 3:21049
**COMBUSTORS**
*See also BURNERS*
*COMBUSTION CHAMBERS*
**COMBUSTORS/EFFICIENCY**
Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission, 3:21867
**COMBUSTORS/FLOW MODELS**
Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission, 3:21867
**COMBUSTORS/PERFORMANCE TESTING**
Experimental study on the emissions of a model gas turbine combustor, 3:21866
On heat transmission in radiation combustion chambers by heaters, 3:21516 (DOE-tr-30)
**COMBUSTORS/TECHNOLOGY ASSESSMENT**
Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan, 3:21485 (FE-2292-9)
**COMMERCIAL BUILDINGS/TOTAL ENERGY SYSTEMS**
HUD Utilities Demonstration Series. Volume 7. Performance analysis of the Jersey City total energy sits. Interim report, 3:21705 (PB-269517)
**COMMERCIAL NUCLEAR SHIPS/COST**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 3. Ship safety. Final report, 3:21630 (PB-269725)
**COMMERCIAL NUCLEAR SHIPS/DESIGN**
Nuclear powered tanker. maritime design study for 600,000 DWT nuclear tanker. Volume 2. Preliminary design. Final report, 3:21629 (PB-269724)
**COMMERCIAL NUCLEAR SHIPS/ECONOMICS**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 5. Economic evaluation. Final report, 3:21632 (PB-269727)
**COMMERCIAL NUCLEAR SHIPS/ENGINEERING**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 4. Engineering and production support. Final report, 3:21631 (PB-269726)
**COMMERCIAL NUCLEAR SHIPS/SAFETY**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 3. Ship safety. Final report, 3:21630 (PB-269725)
**COMMERCIAL NUCLEAR SHIPS/SPECIFICATIONS**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 1. Preliminary specifications (Mod 1). Final report, 3:21628 (PB-269723)
**COMMUNITIES**
Old field vegetation as an inhibitor of tree vegetation, 3:22199
**COMMUNITIES/ENERGY MANAGEMENT**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**COMMUNITIES/ICES**
State of the art for integrated Energy/Utility Systems, 3:21849 (PB-269684)
**COMMUNITIES/PLANNING**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume I, 3:21681 (HCP/M3879-1(Vol.1))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Executive summary, 3:21682 (HCP/M3879-0003)
**COMPOSITE MATERIALS**
*See also SUPERCONDUCTING COMPOSITES*
**COMPOSITE MATERIALS/FABRICATION**
Magnetohydrodynamic electrode (Patent; ceramic-metal composite), 3:21762
**COMPOUND PARABOLIC CONCENTRATORS**
*See also PARABOLIC REFLECTORS*
**COMPOUND PARABOLIC CONCENTRATORS/COMPARATIVE EVALUATIONS**
Compound trapezoidal collector (an optimized stationary concentrator), 3:21375
**COMPUTER CODES**
Proposal for development of an interactive project management code, 3:22688 (UCID-17613)
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**COMPUTER CODES/A CODES**
User's manual for the CDC-6600 version of AMPX, 3:22385 (SAND-77-1148)
**COMPUTER CODES/I CODES**
Insider safeguards effectiveness model (ISEM). User's guide, 3:21221 (SAND-77-0043)
**COMPUTER CODES/K CODES**
Bush Dome model computing movement of injected crude helium. General instruction manual for computer program KWDX-577-mp for computing gas movement in a gas storage reservoir. Final report, 3:21691 (PB-269451)
**COMPUTER CODES/L CODES**
LASNEX code for inertial confinement fusion, 3:22651 (UCRL-80169)
LEG System: a general Lagrangian-to-Eulerian hydrodynamic code linkage (For CDC 7600), 3:22323 (UCID-17680)
**COMPUTER CODES/M CODES**
Diagnostic programs used with McGUS a 3D mirror equilibrium code, 3:22422 (UCID-17650)
**COMPUTER CODES/P CODES**
PHD-IV, a laser-plasma simulation code, 3:22670

**COMPUTER CODES/S CODES**
Monte Carlo simulation of turbulent atmospheric transport: comparison with experimental data, 3:22192
**COMPUTER NETWORKS/DESIGN**
Design and implementation of a local computer network, 3:22689 (CONF-7706104-1)
**COMPUTERS/RESEARCH PROGRAMS**
Studies in the organization of computer systems. 1977 progress summary. Technical note No. 121 (Digital Systems Laboratory, Stanford University), 3:22693 (SU-326-P.39-26)
**CONCENTRATING COLLECTORS/COMPARATIVE EVALUATIONS**
Compound trapezoidal collector (an optimized stationary concentrator), 3:21375
**CONCENTRATING COLLECTORS/DATA ACQUISITION**
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report, 3:21369 (N-77-26610)
**CONCENTRATING COLLECTORS/DESIGN**
Compound trapezoidal collector (an optimized stationary concentrator), 3:21375
**CONCENTRATING COLLECTORS/RESEARCH PROGRAMS**
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report, 3:21369 (N-77-26610)
**CONDENSATES/EXTRACTION**
Design of automatic condensate extractors, 3:21084
**CONDENSATES/TWO-PHASE FLOW**
Shape of cross section of condensate film in pipes with two-phase flow, 3:21036
**CONDENSATION CHAMBERS/STRESSES**
BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function, 3:21650 (UCID-17662)
**CONSERVATION (RESOURCE)**
*See RESOURCE CONSERVATION*
**CONTACTORS**
*See SWITCHES*
**CONTAINERS**
*See also CASKS*
*PRESSURE VESSELS*
*TANKS*
**CONTAINERS/DESIGN**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**CONTAINERS/SAFETY**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**CONTINENTAL SHELF/LEASING**
Outer Continental Shelf Sale 40: inadequate data used to select and evaluate lands to lease. Department of the Interior. Report to the Congress, 3:21729 (PB-269865)
**CONTROL SYSTEMS**
*(For automated processes including feedback.)*
*See also ON-LINE CONTROL SYSTEMS*
*REACTOR CONTROL SYSTEMS*
**CONTROL SYSTEMS/MEETINGS**
Proceedings of the 1975 IEEE conference on decision and control, 3:21469
**CONTROL THEORY (REACTOR)**
*See REACTOR KINETICS*
**CONVECTIVE INSTABILITIES**
Parametric excitation of low-frequency convective cell modes by a large amplitude lower-hybrid wave in a plasma, 3:22501
**CONVECTIVE INSTABILITIES/INSTABILITY GROWTH RATES**
Filamentation of large amplitude lower-hybrid waves, 3:22496
**CONVERTERS (IMAGE)**
*See IMAGE CONVERTERS*
**COOK INLET**
*See GULF OF ALASKA*
**COOLANT CLEANUP SYSTEMS**
Chemistry of feedwater for boiling-water and pressurized-water reactors (Condensate polishing plants), 3:21558
**COOLERS**
*See HEAT EXCHANGERS*
**COOLING SYSTEM (REACTOR)**
*See REACTOR COOLING SYSTEMS*
**COOLING TOWERS/GOVERNMENT POLICIES**
Federal role in dry and wet-dry cooling tower research, development, and demonstration, 3:21472 (COO/4188-2)
**COOLING TOWERS/PLUMES**
First annual report on weather modification effects of cooling towers, 3:22149 (TID-27836)
**COPPER/CHEMICAL ANALYSIS**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**COPPER/CHEMICAL STATE**
Review of the chemical speciation of copper in seawater, 3:22214 (RLO/2229/T1-41)
**COPPER/THERMAL CONDUCTIVITY**
Effect of the diameter and length of fibers on carcass heat conductivity of metal fiber wicks of heat pipes, 3:22005
**COPPER 65 TARGET/KRYPTON 86 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**COPPER ALLOYS**
*See also COPPER BASE ALLOYS*
**COPPER ALLOYS/CORROSION PROTECTION**
Increasing the endurance limit and corrosion resistance of light-alloy drill pipes, 3:20983
**COPPER BASE ALLOYS/FATIGUE**
Evaluation of the fatigue resistance of CDA 182 copper for use in the impurity study experiment fusion research tokamak (ISX) (CDA 182 copper), 3:22682 (ORNL-5302)
**COPPER COMPLEXES/CHEMICAL BONDS**
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy (Ferric, manganous, cuprous, cupric, and vanadyl ion binding), 3:21976 (LBL-6682)
**COPPER OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**CORONA (SOLAR)**
*See SOLAR CORONA*
**COSMIC GAMMA SOURCES/SPECTROSCOPY**
Radiation in space and its effects on high-energy astronomy experiments: a summary, 3:22298
**COSMIC NUCLEI/NUCLEAR REACTIONS**
Multiple generation of particles in collisions of nuclei of energy higher than $10^{12}$ eV, 3:22336
**COSMIC PHOTONS/SPECTROSCOPY**
Induced radiations in spacecraft as background to gamma/x-ray measurements, 3:22292
**COSMIC RAY DETECTION**
Radiation background in space and its evaluation, 3:22291
**COSMIC RAY DETECTION/ACTIVATION DETECTORS**
Experimental determination of cosmic-ray particle fluxes, 3:22294
**COSMIC RAY FLUX**
Radiation background in space and its evaluation, 3:22291
**COSMIC RAY FLUX/MEASURING METHODS**
Experimental determination of cosmic-ray particle fluxes, 3:22294
**COSMIC X-RAY SOURCES**
X-ray and gamma-ray line production by nonthermal ions, 3:22297 (N-77-27061)
**COSMIC X-RAY SOURCES/SPECTROSCOPY**
Radiation in space and its effects on high-energy astronomy experiments: a summary, 3:22298
**COSMIC X-RAY SOURCES/X-RAY DETECTION**
Background effects in scintillation counter telescopes in the upper atmosphere, 3:22125
**COSMIC X-RAY SOURCES/X-RAY SPECTRA**
OSO-8 x-ray observations of AM Hersoulis, 3:22296 (N-77-27050)
**COTTON PLANTS/GROWTH**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**COUNTERS (RADIATION)**
*See RADIATION DETECTORS*
**COVERINGS/WEATHERING**
Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July-September 1977, 3:21275 (ERDA/JPL/954458-77/6)
**CRATERING EXPLOSIONS**
Effect of detonation depth on the action of underground explosions in rock, 3:22137 (LA-tr-77-65)
**CRBR REACTOR**
*See CLINCH RIVER BREEDER REACTOR*
**CRESOLS/PYROLYSIS**
Study of the pyrolysis of toluene and phenols at low pressure, 3:20896
**CRESYLIC ACID**
*See CRESOLS*
**CRITICAL ASSEMBLIES**
*See ZERO POWER REACTORS*
**CRUDE OIL**
*See PETROLEUM*
**CRYOGENICS**
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**CRYOPUMPS/PERFORMANCE TESTING**
Performance of 4.2 K cryopumps in neutral beam injectors, 3:22684
**CRYSTAL LATTICES/DEFORMATION**
Stepwise deformation, 3:22393 (UCRL-Trans-11291)
**CURIUM 242/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)

**CURIUM 244/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**CURIUM ISOTOPES/SPONTANEOUS FISSION**
Spontaneously fissioning isomers, 3:22375
**CUTTING TOOLS/DESIGN**
Phenomenon of jamming in single rolling cutter bit bearings, 3:20977
**CUTTING TOOLS/PERFORMANCE**
Slicing of silicon into sheet material. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Sixth quarterly report, June 18, 1977-September 18, 1977, 3:21274 (ERDA/JPL/954374-77/3)
**CUTTING TOOLS/RELIABILITY**
Phenomenon of jamming in single rolling cutter bit bearings, 3:20977
**CYANIDES/CRYSTAL STRUCTURE**
Crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ and $Cd_3[Co(CN)_6]_2.12H_2O$ by neutron and x-ray diffraction, 3:21956
Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate, 3:21970
**CYANIDES/RADIATION SCATTERING ANALYSIS**
X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts, 3:21935
**CYCLOHEXANE/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**CYCLOHEXANE/THERMODYNAMIC PROPERTIES**
Experimental investigation of P-V-T dependence of cyclohexane and benzene at the melting line, 3:21042
**CYCLOPENTADIENE/CRYSTAL STRUCTURE**
High-precision neutron diffraction investigation of the prototype biscyclopentadienyl transition metal hydride $(eta^5\text{-}C_5H_5)_2MoH_2$ and resolution of the structure in terms of modern bonding theory, 3:21951
**CYCLOTRON INSTABILITY/INSTABILITY GROWTH RATES**
Modifications in the maximum convective growth rate of the electromagnetic proton cyclotron instability due to the presence of thermal ions, 3:22495
Second-order theory for kparallel$B_0$ electromagnetic instabilities, 3:22481
**CYCLOTRON INSTABILITY/TIME RESOLUTION**
K-spectrum analysis of the nonlinear time development of the electron cyclotron instability, 3:22489
**CZECHOSLOVAKIA/HEAT FLOW**
Terrestrial heat flow in two deep holes in the Ostrova-Karvina coal basin, 3:21410

## D

**D RESONANCES/BOUND STATE**
Relative yield of D mesons in hadronic collisions, 3:22346
**D RESONANCES/PARTICLE PRODUCTION**
Relative yield of D mesons in hadronic collisions, 3:22346
**D-1285 RESONANCES/DECAY**
$Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications (Rates), 3:22351
**DAMS/FOUNDATIONS**
Problem of foundation-structure interaction in large dams and other massive systems, 3:21265
**DAMS/STRESSES**
Problem of foundation-structure interaction in large dams and other massive systems, 3:21265
**DATA ACQUISITION SYSTEMS**
*See also CAMAC SYSTEM*
Data aquisition and processing system, 3:22129 (SAND-77-1914C)
**DAUGHTER PRODUCTS/ALPHA DOSIMETRY**
Radon and daughter measurements with active and passive devices using track etch detectors, 3:22165 (HASL-325)
**DAUGHTER PRODUCTS/CARCINOGENESIS**
Exposure to radon daughters and the incidence of lung cancer, 3:22256
**DC RESINS/HYDROLYSIS**
Hydrogen gas from cured RTV silicones, 3:21977 (MHSMP-77-60)
**DDT**
*(Dichlorodiphenyltrichloroethane.)*
**DDT/BIOLOGICAL EFFECTS**
Environmental significance of fin erosion in Southern California demersal fishes (Microstomus pacificus), 3:22219
**DEASHING/ECONOMICS**
Application of Lummus antisolvent deashing technology to a solvent refined coal solution. Final report, 3:20876 (EPRI-AF-234)
**DEASHING/EFFICIENCY**
Application of Lummus antisolvent deashing technology to a solvent refined coal solution. Final report, 3:20876 (EPRI-AF-234)
**DECALSO**
*See ION EXCHANGE MATERIALS*
**DELAYED PROTON PRECURSORS/REVIEWS**
Delayed proton radioactivities, 3:22384
**DELAYED PROTONS**
Delayed proton radioactivities, 3:22384
**DEMONSTRATION PLANTS**
*See also INDUSTRIAL PLANTS*
**DEMONSTRATION PLANTS/ENVIRONMENTAL IMPACT STATEMENTS**
Alternative Fuels Demonstration Program. Final environmental impact statement, 3:20912 (ERDA-1547(Vol.2))
**DEOXYPENTOSE NUCLEIC ACID**
*See DNA*
**DEOXYRIBONUCLEIC ACID**
*See DNA*
**DESOXYRIBONUCLEIC ACID**
*See DNA*
**DETECTORS (RADIATION)**
*See RADIATION DETECTORS*
**DETONATION WAVES**
*See SHOCK WAVES*
**DETONATORS/POWER SUPPLIES**
Digital RLC analysis of CDU fireset x-units, 3:22138 (BDX-613-1945)
**DEUTERIDES/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**DEUTERIDES/FLUORESCENCE**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**DEUTERIUM/ELECTROPHORESIS**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**DEUTERIUM/ISOTOPE EFFECTS**
Gas phase $^{13}C$ chemical shifts and coupling constants in the deuteromethanes, 3:22309
**DEUTERIUM IONS/PRODUCTION**
High energy negative deuterium beams using double charge-exchange or surface production, 3:22621 (UCRL-80406)
**DEUTERIUM TRITIDES/FABRICATION**
Fabrication of cryogenic laser fusion targets, 3:21236 (UCRL-79442)
**DEUTERONS/D STATES**
Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering, 3:22338 (LA-tr-77-74)
**DEUTERONS/DIFFUSION**
Diffusion of light particles in metals, 3:22392
**DEUTERONS/NUCLEAR FORCES**
New look at the nuclear force, 3:22380 (SLAC-PUB-1601)
**DEUTERONS/POLARIZATION**
Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering, 3:22338 (LA-tr-77-74)
**DEVELOPING COUNTRIES/ECONOMIC DEVELOPMENT**
OPEC special fund (To assist DC's and promote new international order), 3:21686
**DIALYSIS/MASS TRANSFER**
Mass transfer characterization of Donnan dialysis, 3:21944
**DIAMOND DRILLING EQUIPMENT**
*See DRILLING EQUIPMENT*
**DICHLORODIPHENYLTRICHLOROETHANE**
*See DDT*
**DIELECTRIC TRACK DETECTORS/COMPARATIVE EVALUATIONS**
Comparison of errors of integrating working level devices (Radon monitoring), 3:22174 (HASL-325)
**DIELECTRIC TRACK DETECTORS/COST**
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)
**DIELECTRIC TRACK DETECTORS/PERFORMANCE**
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)
**DIELECTRIC TRACK DETECTORS/PERFORMANCE TESTING**
Radon and daughter measurements with active and passive devices using track etch detectors, 3:22165 (HASL-325)

**DIESEL ENGINES/EXHAUST GASES**
$NO_2$ levels in diesel exhaust, 3:22090 (BERC/TPR-78/1)
**DIESEL ENGINES/FUEL CONSUMPTION**
Energy usage and other comparisons between gasoline and diesel medium duty trucks, 3:21852
**DIESEL ENGINES/RELIABILITY**
Method of combining diesel-generator set detailed component models into a composite model (Nuclear power plants), 3:21601
**DIESEL ENGINES/SUPERCHARGERS**
Low compression ratio highly supercharged two-stroke engine, 3:21853
**DIESEL ENGINES/TECHNOLOGY ASSESSMENT**
Internal combustion piston engines, 3:21846 (ANL/CES/TE-77-1)
**DIESEL ENGINES/THERMAL EFFICIENCY**
Low compression ratio highly supercharged two-stroke engine, 3:21853
**DIESEL FUELS/ADDITIVES**
Effectiveness of smoke suppression additives for diesel fuels, 3:21000
**DIET/RADIATION MONITORING**
Cesium-137 in various Chicago foods (collection month: October 1977), 3:22204 (EML-334)
**DIFFERENTIAL EQUATIONS/NUMERICAL SOLUTION**
Computational aspects of Glimm's method, 3:22000 (LBL-7228)
Dynamic ADI methods for elliptic equations with gradient dependent coefficients, 3:22691 (LBL-6142)
Methods for oscillating problems, 3:22690 (COO-2383-45)
Starting an ODE solver (Selection of initial step size), 3:22692 (SAND-77-1023)
**DIFFUSION/MATHEMATICAL MODELS**
Applicability of accepted diffusion models to near stack dose calculations, 3:22193
**DIGITAL SYSTEMS/RESEARCH PROGRAMS**
Studies in the organization of computer systems. 1977 progress summary. Technical note No. 121 (Digital Systems Laboratory, Stanford University), 3:22693 (SU-326-P.39-26)
**DIHYDROXYAROMATICS**
*See POLYPHENOLS*
**DIMETHYLBENZENES**
*See XYLENES*
**DIOLS**
*See GLYCOLS*
**DIPROTONS/BARYON RESONANCES**
Suggestion for a dibaryon resonance in the pp system, 3:22342
**DISEASE VECTORS/STERILE MALE TECHNIQUE**
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967-September 1977, 3:22264 (COO-38-1838)
**DISPLACEMENT GAGES/PERFORMANCE TESTING**
Displacement measurements at high temperatures with capacitive transducers ($CO_2$ cooled reactor), 3:21577
**DISTRICT HEATING**
Control system of the T-250/300-240 steam turbine, 3:21502
Design and experience in the operation of the Danziger Strasse gas- and oil-fired thermal Power Plant of the Oberhausen Power Supply Company, 3:21518
Water splitting for the production of non-polluting energy carriers, 3:21247
**DISTRICT HEATING/HEAT DISTRIBUTION SYSTEMS**
Long-distance heating systems (Book, in German), 3:21706
**DIVERTORS/ALPHA REACTIONS**
Plasma-wall-divertor model for tokamaks, 3:22588
**DIVERTORS/MATHEMATICAL MODELS**
Plasma-wall-divertor model for tokamaks, 3:22588
**DNA**
*(Deoxyribonucleic acid.)*
**DNA/CHROMOSOMAL ABERRATIONS**
Critical DNA damage and mammalian cell reproduction, 3:22251
**DNA/DISTRIBUTION**
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr-77-86)
**DNA REPLICATION/BIOCHEMICAL REACTION KINETICS**
Critical DNA damage and mammalian cell reproduction, 3:22251
**DOLOMITE/DRILLING**
Full-scale laboratory drilling tests on sandstone and dolomite. Final report, 3:20952 (COO/4098-1)
**DOMESTIC ANIMALS/PRODUCTION**
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables (27 crop and 10 livestock commodities), 3:21749 (FEA/D-77/140)
**DOMESTIC SAFEGUARDS/COMPUTER CODES**
Insider safeguards effectiveness model (ISEM). User's guide, 3:21221 (SAND-77-0043)
**DOW PUSHER 700**
*See POLYAMIDES*
**DRAG EFFECT**
*See ELECTROPHORESIS*
**DRIFT INSTABILITY/ANALYTICAL SOLUTION**
Theory and numerical simulations on collisionless drift instabilities in three dimensions, 3:22477 (PPPL-1397)
**DRIFT INSTABILITY/KORTEWEG-DE VRIES EQUATION**
Propagation of nonlinear electrostatic drift solitary waves in a collisionless plasma consisting of two ion species, 3:22502
**DRIFT INSTABILITY/STABILIZATION**
Nonlinear stabilization of the lower-hybrid-drift instability by electron resonance broadening, 3:22487
Variational method for electromagnetic waves in a magneto-plasma, 3:22494
**DRILL BITS**
*See also DRILLING EQUIPMENT*
*DRILLS*
**DRILL BITS/DESIGN**
Phenomenon of jamming in single rolling cutter bit bearings, 3:20977
**DRILL BITS/RELIABILITY**
Phenomenon of jamming in single rolling cutter bit bearings, 3:20977
**DRILL PIPES/CORROSION PROTECTION**
Increasing the endurance limit and corrosion resistance of light-alloy drill pipes, 3:20983
**DRILL PIPES/MECHANICAL PROPERTIES**
Determination of the service life of drill pipes according to the cyclic strength criterion, taking account of loadings during lifting and sinking operations, 3:20970
**DRILL PIPES/SERVICE LIFE**
Determination of the service life of drill pipes according to the cyclic strength criterion, taking account of loadings during lifting and sinking operations, 3:20970
Increasing the endurance limit and corrosion resistance of light-alloy drill pipes, 3:20983
**DRILLING EQUIPMENT**
*See also DRILL BITS*
*DRILL PIPES*
*DRILLS*
**DRILLING EQUIPMENT/MECHANICAL VIBRATIONS**
Some results of investigation of the functioning of antivibration devices, 3:20963
**DRILLING EQUIPMENT/POWER SUPPLIES**
Obtaining a circular rotating field in a capacitor electrodrill operating at different depths, 3:20966
**DRILLING FLUIDS/PERFORMANCE TESTING**
Field test of mud on temperature effect, 3:21442
**DRILLING FLUIDS/TEMPERATURE EFFECTS**
Field test of mud on temperature effect, 3:21442
**DRILLING FLUIDS/THERMODYNAMIC PROPERTIES**
Thermostable flushing fluids for well drilling in West Siberia, 3:20965
**DRILLING MUD**
*See DRILLING FLUIDS*
**DRILLING PLATFORMS**
*See OFFSHORE PLATFORMS*
**DRILLING RIGS/SPECIFICATIONS**
Emplacement hole drill evaluation and specification study. Volume II. Appendices, 3:22016 (Y/OWI/SUB-77-22324(Vol.2)(App.))
**DRILLS**
*See also DRILL BITS*
*DRILLING EQUIPMENT*
*WELL DRILLING*
**DRILLS/SPECIFICATIONS**
Emplacement hole drill evaluation and specification study. Volume II. Appendices, 3:22016 (Y/OWI/SUB-77-22324(Vol.2)(App.))
**DRINKING WATER/HEALTH HAZARDS**
Drinking water and health. Part II, Chapters 6 and 7. A report of the safe drinking water committee. Final report, 3:22225 (PB-270423)
**DRINKING WATER/RADIOACTIVITY**
Drinking water and health. Part II, Chapters 6 and 7. A report of the safe drinking water committee. Final report, 3:22225 (PB-270423)
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457, 3:22224 (N-77-26934)
Radiostrontium in milk and tap water (New York City), 3:22206 (EML-334(App.))
**DRINKING WATER/RADIOMETRIC ANALYSIS**
Analyses of quality control samples at EML and a contractor laboratory during 1977 (Samples of bone, food, tap water and fallout $^{90}Sr$, $^{137}Cs$), 3:22143 (EML-334)
**DRINKING WATER/WATER POLLUTION**
Drinking water and health. Part II, Chapters 6 and 7. A report of the safe drinking water committee. Final report, 3:22225 (PB-270423)

**DROSOPHILA/BIOLOGICAL RADIATION EFFECTS**
Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr-77-75)
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr-77-67)
**DROSOPHILA/EMBRYOS**
Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr-77-75)
**DROSOPHILA/POPULATIONS**
Average number of generations until extinction and rate of allelism of lethal genes in a sub-divided population (Drosophila), 3:22239 (RLO/2225/T5-35)
**D-T REACTORS/IMPURITIES**
Chemical aspects of controlled thermonuclear synthesis problem. Review, 3:22629
**DUAL-FUEL ENGINES/TECHNOLOGY ASSESSMENT**
Internal combustion piston engines, 3:21846 (ANL/CES/TE-77-1)
**DUAL-PURPOSE POWER PLANTS**
Results of thermal tests of the prototype of the type t-250/322-240 turbine set made by the urals turbomachinery plant, 3:21501
**DUAL-PURPOSE POWER PLANTS/COAL GASIFICATION**
Combination of thermal power processes with a fuel conversion process (Patent), 3:21467
**DUAL-PURPOSE POWER PLANTS/DESIGN**
Design and experience in the operation of the Danziger Strasse gas- and oil-fired thermal Power Plant of the Oberhausen Power Supply Company, 3:21518
**DUAL-PURPOSE POWER PLANTS/PERFORMANCE**
Design and experience in the operation of the Danziger Strasse gas- and oil-fired thermal Power Plant of the Oberhausen Power Supply Company, 3:21518
**DUAL-PURPOSE POWER PLANTS/STEAM TURBINES**
Control system of the T-250/300-240 steam turbine, 3:21502
**DUST COLLECTORS/DESIGN**
Analysis of the high-temperature particulate collection problem, 3:20922 (ANL-77-14)
**DUSTS/CHEMICAL ANALYSIS**
Petrographic method for selective determination of a component (raw coal) in a mixture of products from processing of coal, 3:20850 (CONF-780305-1)
**DUSTS/CLASSIFICATION**
Granular bed filter development program: particle sampling facility operation, 3:20902 (FE-2579-10)
**DUSTS/SAMPLING**
Granular bed filter development program: particle sampling facility operation, 3:20902 (FE-2579-10)
**DYE LASERS/EFFICIENCY**
Laser pump development. Final report, 3:22025 (UCRL-13762)
**DYE LASERS/GAIN**
Effect of laser dye deterioration on performance, 3:22037
**DYE LASERS/TUNING**
Magnetic tuning system for dye lasers, 3:22040
**DYNAMICAL GROUPS/HARMONICS**
Computation of cubic harmonics, 3:22399
**DYNAMICS (BEAM)**
*See BEAM DYNAMICS*

## E

**E-1422 RESONANCES/DECAY**
$Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications (Rates), 3:22351
**EARTH ATMOSPHERE**
*See also AIR*
*IONOSPHERE*
*STRATOSPHERE*
*SURFACE AIR*
*TROPOSPHERE*
**EARTH ATMOSPHERE/DIFFUSION**
Hanford 67-series: a volume of atmospheric field diffusion measurements, 3:22141 (PNL-2433)
**EARTH ATMOSPHERE/RADIONUCLIDE MIGRATION**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
Monte Carlo simulation of turbulent atmospheric transport: comparison with experimental data, 3:22192
**EARTH CRUST/HEAT FLOW**
High heat flow measured in Ostrova-Karvina coal basin, 3:21454
**EARTH PENETRATORS/RECOVERY**
Locating a buried earth penetrator, 3:22001 (SAND-77-0646)
**EARTH-COVERED BUILDINGS/SOLAR HEATING SYSTEMS**
Terraset: taking less from the Earth, 3:21353
**EARTHQUAKES/FORECASTING**
Mechanism of change with time of seismic wave speed (effect of water and heat), 3:21399
**EAST MESA GEOTHERMAL FIELD**
*See also IMPERIAL VALLEY*
**EAST MESA GEOTHERMAL FIELD/TEST FACILITIES**
ERDA Geothermal Component Test Facility (GCTF), East Mesa, Imperial Valley, California. Test operations management plan, 3:21449 (TID-28010)
**E-BEAM TYPE REACTORS/ECONOMIC DEVELOPMENT**
Economic model of a relativistic electron beam hybrid reactor, 3:22662
**EBIS**
*See ELECTRON BEAM ION SOURCES*
**ECONOMIC DEVELOPMENT/FINANCING**
OPEC special fund (To assist DC's and promote new international order), 3:21686
**ECR HEATING/RADIATION SOURCES**
Cyclotron masers (gyrotrons) as potent millimetre-wave sources, 3:22409
**EDUCATION/MEETINGS**
Education confronts the energy dilemma, 3:21678 (CONF-7706101-)
**EFFLUENTS (CHEMICAL)**
*See CHEMICAL EFFLUENTS*
**EHV AC SYSTEMS/POWER TRANSMISSION LINES**
New 380 kV lines constructed by the Bayernwerk AG, 3:21551
**ELECTRIC APPLIANCES**
*See also AIR CONDITIONERS*
*WATER HEATERS*
**ELECTRIC APPLIANCES/ENERGY CONSUMPTION**
Lowering the electricity consumption of the larger domestic electric appliances, 3:21788
**ELECTRIC ARCS/FLOW RATE**
Flow velocity measurement in high-current arcs using Doppler-shifted plasma scattering, 3:22435
**ELECTRIC ARCS/PLASMA DIAGNOSTICS**
Flow velocity measurement in high-current arcs using Doppler-shifted plasma scattering, 3:22435
**ELECTRIC CONTACTORS**
*See SWITCHES*
**ELECTRIC CURRENTS**
*See also ELECTRIC ARCS*
**ELECTRIC CURRENTS/COMPRESSION**
High power pulse compression techniques (Patent), 3:22606
**ELECTRIC FIELDS/BIOLOGICAL EFFECTS**
Biologic effects of electric and magnetic fields associated with proposed Project Seafarer, 3:22280 (AD-A-042515)
**ELECTRIC FILTERS/DESIGN**
Cancel 60 Hz and other noise, 3:22081
**ELECTRIC GENERATORS**
*(Rotating generators only; excludes DIRECT ENERGY CONVERTERS.)*
*See also TURBOGENERATORS*
**ELECTRIC GENERATORS/COST**
EPR ohmic heating energy storage, 3:22605 (WFPS-TME-064)
**ELECTRIC GENERATORS/DESIGN**
TEXT Energy Storage System, 3:22604 (ORO-5594-9)
**ELECTRIC GENERATORS/MATHEMATICAL MODELS**
Voltage and reactive production programming in an electric system. II. Notes on mathematical models of generators and loads, 3:21511
**ELECTRIC GENERATORS/PERFORMANCE**
EPR ohmic heating energy storage, 3:22605 (WFPS-TME-064)
**ELECTRIC GENERATORS/SAFETY**
ORMAK upgrade ohmic coil generator protection, 3:22603 (ORNL/TM-6079)
**ELECTRIC HEATING**
Electric pipe heater (Patent), 3:21778
**ELECTRIC POWER/CHARGES**
Industrial electric power rates in the mid-1980s, 3:21744
Is the development of large power plant units reasonable, 3:21520
**ELECTRIC POWER/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ELECTRIC POWER/DEMAND FACTORS**
Impacts of the western drought on the regional electricity situation (Pacific Northwest), 3:21743 (TID-28064)
Industry in national planning: the power industry (1985 and 2005), 3:21742 (SIND-PM-1977-3)
**ELECTRIC POWER/ENERGY SUPPLIES**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
**ELECTRIC POWER/MEETINGS**
Proceedings of the twelfth session of the Sub-Committee on Energy Resources and Electric Power, 3:21745

**ELECTRIC SWITCHES**
*See SWITCHES*
**ELECTRIC UTILITIES**
*See PUBLIC UTILITIES*
**ELECTRIC UTILITIES/CHARGES**
Industrial electric power rates in the mid-1980s, 3:21744
**ELECTRIC UTILITIES/FUELS**
Status of coal supply contracts for new electric generating units, 1976-1985, 3:21727 (TID-28066)
**ELECTRIC UTILITIES/MANAGEMENT**
Regulatory constraints on solar energy and thermal-storage installations, 3:21746
**ELECTRIC UTILITIES/OFF-PEAK ENERGY STORAGE**
Off-peak energy storage concept for electric utilities: Part I. Electric utility requirements, 3:21521
Regulatory constraints on solar energy and thermal-storage installations, 3:21746
**ELECTRIC UTILITIES/PLANNING**
Status of coal supply contracts for new electric generating units, 1976-1985, 3:21727 (TID-28066)
**ELECTRIC UTILITIES/PUBLIC RELATIONS**
Energy management seminar (Seattle City Light's attempt to assist customers in energy efficiency), 3:21710
**ELECTRICAL INSULATION/FABRICATION**
Antistatic resp. conducting polymers filled with carbon black, 3:22006
**ELECTRICAL INSULATORS/MATERIALS TESTING**
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL-2004-6)
**ELECTRICAL SURVEYS/DATA PROCESSING**
Methods for interpretation of geophysical exploration data from heterogeneous carbonate reservoirs with compound porous space (on the example of Lower Cretaceous and Upper Jurassic deposits in ChI ASSR), 3:20946
**ELECTRIC-POWERED VEHICLES/PERFORMANCE TESTING**
Test and evaluation of 23 electric vehicles for state-of-the-art assessment, 3:21856 (CONS/1011-21)
**ELECTRODES**
*See also CATHODES*
**ELECTRODES/GRAVIMETRIC ANALYSIS**
Vacuum-microgravimetric characterization of catalyst candidates for fuel cell electrodes, 3:21770
**ELECTRODES/MATERIALS TESTING**
Development, characterization, and evaluation of materials for open cycle MHD. Quarterly report, March 1977, 3:21758 (BNWL-2004-6)
**ELECTROLYTES**
Electrolyte theory: improvements since Debye and Hueckel, 3:21987
**ELECTROLYTIC CELLS/FAILURES**
Investigation of a lithium electrolytic cell failure, 3:21986 (Y-2107)
**ELECTROMAGNETIC RADIATION**
*See also INFRARED RADIATION*
*LASER RADIATION*
*ULTRAVIOLET RADIATION*
*VISIBLE RADIATION*
*X RADIATION*
**ELECTROMAGNETIC RADIATION/BESSEL FUNCTIONS**
Roots of two transcendental equations determining the frequency spectra of standing spherical electromagnetic waves, 3:22402
**ELECTROMAGNETIC RADIATION/COUPLING**
New approach of studying electromagnetic mode coupling in inhomogeneous magnetized plasma. I. Normal incidence, 3:22524
**ELECTROMAGNETIC RADIATION/POLARIZATION**
Equation of polarization transfer in an inhomogeneous magnetized plasma. I. Formalism, 3:22525
**ELECTROMAGNETIC RADIATION/RADIATION HAZARDS**
Biologic effects of electric and magnetic fields associated with proposed Project Seafarer, 3:22280 (AD-A-042515)
**ELECTRON BEAM FURNACES/DESIGN**
Present position of electron beam melting and casting technology, 3:21837
**ELECTRON BEAM ION SOURCES/PERFORMANCE TESTING**
Investigation of multi-charged heavy ion production in an electron beam ion source, 3:22114 (LA-7077-T)
**ELECTRON BEAM TYPE REACTORS**
*See E-BEAM TYPE REACTORS*
**ELECTRON BEAMS/LASER RADIATION**
Analysis of bunching of an electron beam at optical wavelengths, 3:22313
**ELECTRON CYCLOTRON-RESONANCE H**
*See ECR HEATING*
**ELECTRON MICROSCOPY/SAMPLE PREPARATION**
View on techniques of preparation of cell and tissue culture specimens for electron microscopy, 3:22233 (LBL-5638)
**ELECTRON PAIRS/PHOTOPRODUCTION**
Weak neutral currents and photoproduction of lepton pairs, 3:22343
**ELECTRON PLASMA WAVES/DAMPING**
Dynamics of collapse of Langmuir waves in hot plasma, 3:22533
**ELECTRON PLASMA WAVES/GUIDING-CENTER APPROXIMATION**
Non-linear resonant mode coupling in a three-dimensional guiding centre water bag plasma, 3:22515
**ELECTRON PLASMA WAVES/MEASURING METHODS**
Theoretical analysis on radiation and reception characteristics of an oblate spheroidal antenna for electron plasma waves, 3:22429
**ELECTRON SOURCES/RADIATION PROTECTION**
Radiation protection design guidelines for 0.1 to 100 MeV particle accelerator facilities, 3:22097 (NCRP-51)
**ELECTRON SPECTROMETERS/PERFORMANCE**
High energy electron spectra from 1.06 $\mu$m laser produced plasmas, 3:22654 (UCRL-80322(Summ.))
**ELECTRONIC CIRCUITS/DESIGN**
Symmetrical $\pi$ and T attenuators: design data for component power dissipation and resistance, 3:22079 (SAND-77-1599)
**ELECTRONIC EQUIPMENT/DESIGN**
Modification of SEC 3000 bonder for electronic flame-off, 3:22077 (BDX-613-1875)
**ELECTRONIC EQUIPMENT/PHYSICAL RADIATION EFFECTS**
RTG radiation and its effect on spacecraft instrumentation, 3:22128
**ELECTRON-MOLECULE COLLISIONS/EXCITATION**
Doublet→quartet transitions in nitric oxide as detected by electron-impact spectroscopy, 3:22320
**ELECTRON-NUCLEON INTERACTIONS/DEEP INELASTIC SCATTERING**
Composite models of hadrons and large transverse processes, 3:22340
**ELECTRON-POSITRON INTERACTIONS/ANNIHILATION**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
Single-cluster descriptions of jets in $e^+e^-$ annihilation (Decay matrix element, spin-one cluster), 3:22344
**ELECTRON-POSITRON INTERACTIONS/HEAVY LEPTONS**
Search for neutral heavy leptons, 3:22327
**ELECTRON-POSITRON INTERACTIONS/TAU PARTICLE**
Properties of the proposed tau charged lepton, 3:22328
**ELECTROPHORESIS/ISOTOPE EFFECTS**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**ELECTROSLAG WELDING**
Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress, 3:21874 (ZJE-186)
**ELECTROSTATIC PRECIPITATORS/COST**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
**ELECTROSTATIC PRECIPITATORS/DESIGN**
Electric purification of gases, 3:21835
**ELECTROSTATIC PRECIPITATORS/EFFICIENCY**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
**ELECTROSTATIC PRECIPITATORS/PERFORMANCE**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report, 3:20899 (EPRI-FP-291(Vol.1))
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:20900 (EPRI-FP-291(Vol.2))
**ELECTROSTATIC PRECIPITATORS/PERFORMANCE TESTING**
Operation of an electroprecipitator influence of the main parameters, 3:21526
**ELEMENTARY PARTICLES**
*See also HADRONS*
**ELEMENTARY PARTICLES/MASS SPECTRA**
High energy spectroscopy (Review), 3:22341 (FERMILAB-Conf-77/66-THY)
**ELIASHBERG EQUATIONS**
*See GORKOV-ELIASHBERG THEORY*
**ELMO BUMPY TORUS/DESIGN**
Design features of the ELMO Bumpy Torus Reactor (EBTR), 3:22537 (CONF-771109-65)
**ELMO BUMPY TORUS/FEASIBILITY STUDIES**
ELMO Bumpy Torus, 3:22536 (CONF-771109-57)
**ELMO BUMPY TORUS/HIGH-BETA PLASMA**
Macroscopic stability and $\beta$ limits in the ELMO Bumpy Torus, 3:22476 (ORNL/TM-5967)

**ELMO BUMPY TORUS/PLASMA MACROINSTABILITIES**
Macroscopic stability and $\beta$ limits in the ELMO Bumpy Torus, 3:22476 (ORNL/TM-5967)
**ELMO BUMPY TORUS/RESEARCH PROGRAMS**
ELMO Bumpy Torus, 3:22536 (CONF-771109-57)
**ELMO BUMPY TORUS/REVIEWS**
ELMO bumpy torus, 3:22563
**EMBRYOS/BIOLOGICAL RADIATION EFFECTS**
Effect of pions on the embryonal development of the mouse, 3:22263 (LA-tr-77-77B)
**EMISSION SPECTROSCOPY**
*See also FLUORESCENCE SPECTROSCOPY*
**EMISSION SPECTROSCOPY/INTERFERENCE**
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T-741)
**ENERGY**
*See also GEOTHERMAL ENERGY*
*NUCLEAR ENERGY*
*SOLAR ENERGY*
**ENERGY/DECISION MAKING**
Information and data flows in societal problem areas: focus-energy. Final report, 3:21683 (PB-269497)
**ENERGY/EDUCATION**
Education confronts the energy dilemma, 3:21678 (CONF-7706101-)
**ENERGY ACCOUNTING**
Cutting fuel costs, 3:21779
**ENERGY ANALYSIS**
Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB-268850)
**ENERGY ANALYSIS/INFORMATION SYSTEMS**
Energy information and analytic system for New York State, 3:21679 (BNL-22677)
**ENERGY CONSERVATION**
Bureau of Mines research 1976: a summary of significant results in mining, metallurgy, and mineral economics, 3:21697
Energy management seminar (Seattle City Light's attempt to assist customers in energy efficiency), 3:21710
**ENERGY CONSERVATION/DATA ACQUISITION**
Home energy savers program: a little time can save a lot of money, 3:21709 (TID-28047)
**ENERGY CONSERVATION/IMPLEMENTATION**
Proposed program for energy conservation in Utah, 3:21712
**ENERGY CONSERVATION/LEGISLATION**
Conservation of energy through state action, 3:21783
**ENERGY CONSERVATION/RECOMMENDATIONS**
Energy conservation on campus. Volume I. Guidelines, 3:21793 (FEA/D-76/229(Vol.1))
**ENERGY CONSERVATION/REGULATIONS**
Energy conservation competes with regulatory objectives for truckers: Interstate Commerce Commission. Report to the Congress, 3:21803 (PB-269746)
**ENERGY CONSERVATION/REVIEWS**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)
**ENERGY CONSERVATION/TRANSPORTATION SECTOR**
Energy conservation competes with regulatory objectives for truckers: Interstate Commerce Commission. Report to the Congress, 3:21803 (PB-269746)
**ENERGY CONSUMPTION/AIR POLLUTION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENERGY CONSUMPTION/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables (27 crop and 10 livestock commodities), 3:21749 (FEA/D-77/140)
**ENERGY CONSUMPTION/ECONOMICS**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENERGY CONSUMPTION/FEEDBACK**
Feedback as a means of decreasing residential energy consumption. Report PU/CES 34, 3:21784 (COO/2789-1)
**ENERGY DEMAND**
Increasing energy consumption: will the plans be followed, 3:21750
**ENERGY DEMAND/DATA COMPILATION**
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables (27 crop and 10 livestock commodities), 3:21749 (FEA/D-77/140)
**ENERGY DEMAND/ECONOMIC ELASTICITY**
Agricultural energy modeling for policy purposes, 3:21718
Agricultural energy modeling: discussion of linear programming models, 3:21719
**ENERGY DEMAND/FORECASTING**
Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB-268850)
**ENERGY DEMAND/GLOBAL ASPECTS**
Global problems and energy, 3:21696
**ENERGY EFFICIENCY/MEETINGS**
Selected papers from a conference entitled "Focusing on Energy" (6 Papers), 3:21708 (IMMR-24-M3-76)
**ENERGY FACILITIES/CONSTRUCTION**
Archaeological and historical investigations for energy facilities: a state of the art report, 3:21685 (TID-28070)
**ENERGY FACILITIES/SITE SELECTION**
Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report (State and Federal roles), 3:21684 (PB-271104)
**ENERGY MANAGEMENT/PUBLIC RELATIONS**
Energy management seminar (Seattle City Light's attempt to assist customers in energy efficiency), 3:21710
**ENERGY MODELS**
Agricultural energy modeling for policy purposes, 3:21718
Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB-268850)
**ENERGY MODELS/LINEAR PROGRAMMING**
Agricultural energy modeling: discussion of linear programming models, 3:21719
**ENERGY POLICY**
*See also NATIONAL ENERGY PLAN*
Coal as an energy resource: conflict and consensus. Academy forum, Washington, D.C., April 4-6, 1977, 3:20936 (NP-22802)
Education confronts the energy dilemma, 3:21678 (CONF-7706101-)
Energy policy and research: discussion from the USDA perspective, 3:21698
Energy policy and research: discussion from the ERDA perspective, 3:21699
Energy policy and research: discussion from a land-grant-institution perspective, 3:21700
Suggestions for a Phase-II national energy policy. Final report, March 1977-September 1977, 3:21723 (FE/2660-1)
**ENERGY POLICY/PLANNING**
Nuclear power generation, 3:21600
On strategies and fate, 3:21721
**ENERGY POLICY/SOCIAL IMPACT**
Global problems and energy, 3:21696
**ENERGY SHORTAGES/EDUCATION**
Education confronts the energy dilemma, 3:21678 (CONF-7706101-)
**ENERGY SHORTAGES/EVALUATION**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
**ENERGY SHORTAGES/NATURAL GAS**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB-269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB-269366)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS, 3:21815 (PB-269367)
**ENERGY SOURCE DEVELOPMENT/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**ENERGY SOURCE DEVELOPMENT/ECONOMIC IMPACT**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume I, 3:21681 (HCP/M3879-1(Vol.1))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Executive summary, 3:21682 (HCP/M3879-0003)
**ENERGY SOURCE DEVELOPMENT/ENVIRONMENTAL IMPACTS**
Agriculture and energy use in the year 2000: discussion from a natural resource perspective, 3:21717
**ENERGY SOURCE DEVELOPMENT/RESEARCH PROGRAMS**
World Energy Conference reveals Soviet energy strategy, 3:21693
**ENERGY SOURCE DEVELOPMENT/SOCIAL IMPACT**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume I, 3:21681 (HCP/M3879-1(Vol.1))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Executive summary, 3:21682 (HCP/M3879-0003)
**ENERGY SOURCE DEVELOPMENT/WATER RESOURCES**
Long-term availability of water resources for energy development in the central United States, 3:21740 (CONF-7710101-5)

**ENERGY SOURCES**
*See also FOSSIL FUELS*
*NUCLEAR FUELS*
*WASTE HEAT*
*WIND POWER*
**ENERGY SOURCES/AVAILABILITY**
Sources, availability and cost of future energy, 3:21713 (AECL-5816)
**ENERGY SOURCES/COST**
Sources, availability and cost of future energy, 3:21713 (AECL-5816)
**ENERGY SOURCES/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENERGY SOURCES/ECONOMICS**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENERGY SOURCES/ENERGY CONSERVATION**
Evolution of energy resources and their utilization: role of heat, 3:21711
**ENERGY SOURCES/EVALUATION**
Energy resources available to man, 3:21695
**ENERGY SOURCES/MEETINGS**
Proceedings of the twelfth session of the Sub-Committee on Energy Resources and Electric Power, 3:21745
**ENERGY SOURCES/TAXES**
State taxation of geothermal resources compared with state taxation of other energy minerals, 3:21431
**ENERGY STORAGE**
*See also HYDROGEN STORAGE*
*OFF-PEAK ENERGY STORAGE*
**ENERGY STORAGE/MATHEMATICAL MODELS**
Simulation algorithms and their realization by digital computer for calculation of wind- and solar-plant storage-service capacity, 3:21670
**ENERGY STORAGE/SIMULATION**
Simulation algorithms and their realization by digital computer for calculation of wind- and solar-plant storage-service capacity, 3:21670
**ENERGY SUPPLIES/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENERGY SUPPLIES/ECONOMICS**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENERGY SUPPLIES/FORECASTING**
Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB-268850)
**ENERGY SUPPLIES/GOVERNMENT POLICIES**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
Increasing energy consumption: will the plans be followed, 3:21750
**ENERGY SUPPLIES/MEETINGS**
Proceedings of the twelfth session of the Sub-Committee on Energy Resources and Electric Power, 3:21745
**ENERGY SUPPLIES/PLANNING**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
Increasing energy consumption: will the plans be followed, 3:21750
On strategies and fate, 3:21721
**ENERGY SUPPLIES/REVIEWS**
Energy supply for the Federal Republic of Germany. Research and development for the energy supply, 3:21720
**ENGLAND**
*See UNITED KINGDOM*
**ENRICHMENT (ISOTOPIC)**
*See ISOTOPE SEPARATION*
**ENTOMOLOGY**
*See INSECTS*
**ENTRAINMENT SEPARATION**
*See MIST EXTRACTORS*
**ENVIRONMENT**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**ENVIRONMENT/ALPHA DETECTION**
Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**ENVIRONMENT/BETA DETECTION**
Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**ENVIRONMENT/GAMMA DETECTION**
Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**ENVIRONMENT/RESEARCH PROGRAMS**
Environmental control technology activities of the Department of Energy in FY 1977, 3:22230 (DOE/EV-0030)
**ENVIRONMENTAL EXPOSURE PATHWAY/MATHEMATICAL MODELS**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208
**ENVIRONMENTAL IMPACTS/COMPARATIVE EVALUATIONS**
Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants, 3:22196
**ENVIRONMENTAL IMPACTS/EVALUATION**
Environmental protection issues facing the nation (Appraisal by GAO), 3:21688 (PB-269748)
**ENVIRONMENTAL MATERIALS/X-RAY EMISSION ANALYSIS**
Proton-induced x-ray emission multielement analysis in biomedical, environmental, geological, and archaeological specimens, 3:21940
**ENVIRONMENTAL TRANSPORT**
*See also ENVIRONMENT*
**ENVIRONMENTAL TRANSPORT/COMPUTER CALCULATIONS**
Jeremiah Environmental Computational System, 3:22194
**ENVIRONMENTAL TRANSPORT/SIMULATION**
Monte Carlo simulation of turbulent atmospheric transport: comparison with experimental data, 3:22192
**EPIPHYSIS (BONES)**
*See BONE TISSUES*
**EPSTEIN-BARR VIRUS**
*See ONCOGENIC VIRUSES*
**EQUATIONS (DIFFERENTIAL)**
*See DIFFERENTIAL EQUATIONS*
**EQUIPMENT**
*See also DRILLING EQUIPMENT*
*HEAT RECOVERY EQUIPMENT*
**EQUIPMENT/MAINTENANCE**
Valued renewal processes, 3:22002 (SAND-77-1436C)
**EQUIPMENT/RESEARCH PROGRAMS**
Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976-August 1977, 3:20840 (FE-2479-1)
**ERBIUM 166/ENERGY LEVELS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**ERBIUM 166 TARGET/ALPHA REACTIONS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**ESTUARIES/MINERAL CYCLING**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**ESTUARIES/THERMAL POLLUTION**
Thermal impact assessment of multi-power plant operations on estuaries, 3:22229
**ESTUARIES/WATER POLLUTION**
Simulation of chlorinated water discharges from power plants on estuaries and rivers, 3:22216
**ESTUARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**1,2-ETHANEDIOL**
*See GLYCOLS*
**ETHANOL/COST**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**ETHANOL/SYNTHESIS**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**ETHYLENE GLYCOL**
*See GLYCOLS*
**EUROPE**
*See also BELGIUM*
*CZECHOSLOVAKIA*
*FRANCE*
*GERMAN FEDERAL REPUBLIC*
*ICELAND*
*IRELAND*
*UNITED KINGDOM*
*USSR*
*YUGOSLAVIA*
**EUROPE/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**EUROPE/COMMUNITIES**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))

**EUROPIUM COMPLEXES/NUCLEAR MAGNETIC RESONANCE**
Nuclear magnetic resonance study of the structure in solution of lanthanide complexes with benzene-1,2-dioxydiacetate, 3:21960
**EVACUATED TUBE COLLECTORS/DESIGN**
Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975-August 31, 1975, 3:21367 (COO/2608-1)
Internal cusp reflector for an evacuated tubular heat pipe solar thermal collector, 3:21376
**EVACUATED TUBE COLLECTORS/HEAT PIPES**
Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975-August 31, 1975, 3:21367 (COO/2608-1)
**EVACUATED TUBE COLLECTORS/MATHEMATICAL MODELS**
Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975-August 31, 1975, 3:21367 (COO/2608-1)
**EVACUATED TUBE COLLECTORS/OPTICS**
Internal cusp reflector for an evacuated tubular heat pipe solar thermal collector, 3:21376
**EVACUATED TUBE COLLECTORS/SOLAR REFLECTORS**
Internal cusp reflector for an evacuated tubular heat pipe solar thermal collector, 3:21376
**EXPLORATION**
*See also GEOTHERMAL EXPLORATION*
**EXPLORATION/COST**
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G-77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G-77/357)
**EXPLOSIVE INSTABILITY**
Many-wave explosive instability, 3:22492
**EXPLOSIVES**
*See also CHEMICAL EXPLOSIVES*
**EXPLOSIVES/CHEMICAL ANALYSIS**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**EXPLOSIVES/THERMAL ANALYSIS**
Thermochemistry of explosives: a review, 3:22135
**EXPONENTIAL PILES**
*See SUBCRITICAL ASSEMBLIES*
**EXXON LIQUEFACTION PROCESS/SIMULATION**
Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1-November 30, 1976, 3:20860 (MIT-2295T9-2)

## F

**FABRY-PEROT INTERFEROMETER/KERR EFFECT**
Transient behavior of a nonlinear Fabry-Perot, 3:22029
**FAILED ELEMENT MONITORS/PERFORMANCE TESTING**
Sodium engineering and technology. Technical progress report, April, May, June 1977 (LMFBR), 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977 (LMFBR), 3:21586 (HEDL-TME-77-38)
**FALLOUT**
*(For radioactive fallout only.)*
**FALLOUT/DATA COMPILATION**
Quarterly $^{90}$Sr deposition at world land sites (1976 data), 3:22158 (EML-334(App.))
**FALLOUT/ENVIRONMENTAL TRANSPORT**
Cesium-137 in various Chicago foods (collection month: October 1977), 3:22204 (EML-334)
Environmental Measurements Laboratory environmental quarterly, September 1-December 1, 1977, 3:22152 (EML-334)
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**FALLOUT/RADIATION MONITORING**
Appendix to Environmental Measurements Laboratory environmental quarterly, 3:22205 (EML-334(App.))
EML fallout program data, 3:22155 (EML-334)
High altitude balloon sampling program (Fallout monitoring), 3:22157 (EML-334)
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
Quarterly $^{90}$Sr deposition at world land sites (1976 data), 3:22158 (EML-334(App.))
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
Radiostrontium in milk and tap water (New York City), 3:22206 (EML-334(App.))
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**FANS**
*See BLOWERS*
**FARADAY GENERATORS**
*See MHD GENERATORS*
**FARMS/ENERGY CONSUMPTION**
Energy and U.S. agriculture: 1974 data base. Volume 2. Commodity series of energy tables (27 crop and 10 livestock commodities), 3:21749 (FEA/D-77/140)
**FAST BREEDER BLANKET FACILITY (FBBF)**
*See SUBCRITICAL ASSEMBLIES*
**FAST FLUX TEST FACILITY REACTOR**
*See FFTF REACTOR*
**FAST NEUTRONS/NEUTRON DOSIMETRY**
DT fusion neutron irradiation of LLL niobium, 3:22390 (UCID-17669)
**FAST NEUTRONS/TRANSMISSION**
Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM-6108)
**FAST REACTORS**
*See also FFTF REACTOR*
*LMFBR TYPE REACTORS*
**FAST REACTORS/BENCH-SCALE EXPERIMENTS**
Proposal of a method for estimating multiple-rod worth by single-rod experiments, 3:21618
**FAST REACTORS/CONTROL ROD WORTHS**
Proposal of a method for estimating multiple-rod worth by single-rod experiments, 3:21618
**FAST REACTORS/REACTOR MATERIALS**
Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
**FATTY ACIDS**
*See CARBOXYLIC ACIDS*
**FEDERAL REPUBLIC OF GERMANY**
*See GERMAN FEDERAL REPUBLIC*
**FEED MATERIALS PLANTS**
Uranium mill monitoring for natural fission reactors, 3:21109 (LA-7062-MS)
**FEED MATERIALS PLANTS/RADIOACTIVE EFFLUENTS**
Radiological effluent and environmental monitoring for uranium mills: a regulatory viewpoint, 3:22197
Releases of radioactivity from uranium mills and radwaste effluent costs, 3:21206
**FEEDWATER/PUMPING**
Results of tests of a prototype of the PE-600-300-2 feedwater pump, 3:21499
**FEEDWATER/WATER CHEMISTRY**
Chemistry of feedwater for boiling-water and pressurized-water reactors (Condensate polishing plants), 3:21558
**FEEDWATER HEATERS/FABRICATION**
Performance of tube-to-tubeplate welded joints in high pressure feed heaters, 3:21514
**FERRATES**
*See IRON OXIDES*
**FERRITIN/CHEMICAL BONDS**
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy (Ferric, manganous, cuprous, cupric, and vanadyl ion binding), 3:21976 (LBL-6682)
**FERTILIZERS/CHEMICAL ANALYSIS**
Uranium assay of phosphate fertilizers and other phosphatic materials, 3:21941
**FETAL MEMBRANES/MEMBRANE TRANSPORT**
Placental transport of radionuclides. Terminal report, May 1, 1973-July 31, 1975 (Tritiated water, tritium, $^{14}$C, $^{45}$C, and $^{47}$C tracers), 3:22268 (COO-2363-4)
**FETUSES/BIOLOGICAL RADIATION EFFECTS**
Some problems in radiation exposure of pregnant women, 3:22258
**FFTF REACTOR/REACTOR COMPONENTS**
Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME-77-38)
**FILTERS**
*See also ELECTRIC FILTERS*
**FILTERS/COMPARATIVE EVALUATIONS**
Experience in the use of polyurethane foam as a filter material in treating oil-containing wastewaters, 3:21014
**FINLAND/INSOLATION**
Sun as a source of energy in Finland, 3:21269
**FIREHOSE INSTABILITY**
*See HOSE INSTABILITY*
**FIRST WALL/ALPHA REACTIONS**
Plasma-wall-divertor model for tokamaks, 3:22588
Sensitivity studies on 3.5-MeV alpha bombardment of tokamak first wall, 3:22589
**FIRST WALL/COST**
First wall costs of an ion-beam fusion reactor, 3:22642 (UCID-17555)

Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER-582)
**FIRST WALL/HYDRODYNAMICS**
Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**FIRST WALL/MATHEMATICAL MODELS**
Plasma-wall-divertor model for tokamaks, 3:22588
**FIRST WALL/STRESS ANALYSIS**
Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**FIRST WALL/TEMPERATURE DISTRIBUTION**
Temperature distributions in fusion reactor first-wall systems, 3:22590
**FIRST WALL/TEMPERATURE MEASUREMENT**
Temperature and displacement transients in inertial confinement fusion first walls, 3:22671
**FIRST WALL/THERMAL STRESSES**
Thermal responses of tokamak reactor first walls during cyclic plasma burns, 3:22577 (CONF-771029-189)
**FIRST WALL/THERMODYNAMIC PROPERTIES**
Thermal-hydraulics and fatigue-life modeling of lithium-cooled first wall/blanket system, 3:22611
**FISCHER-TROPSCH SYNTHESIS/CATALYSTS**
Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976-July 31, 1977, 3:20858 (FE-2467-4)
**FISCHER-TROPSCH SYNTHESIS/CHEMICAL REACTION KINETICS**
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data, 3:20870
**FISHES**
*See also SALMON*
**FISHES/IMPINGEMENT**
Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs, 3:22210 (ANL/ES-61)
**FISHES/INJURIES**
Environmental significance of fin erosion in Southern California demersal fishes (Microstomus pacificus), 3:22219
**FISHES/SAMPLING**
Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs, 3:22210 (ANL/ES-61)
**FISHES/TEMPERATURE EFFECTS**
Relative roles of conduction and convection in the body temperature change of gizzard shad, Dorosoma cepedianum, 3:22248
**FISSILE MATERIALS**
*(Materials containing nuclides capable of undergoing fission by interaction with slow neutrons.)*
**FISSILE MATERIALS/SAFEGUARDS**
Computerized site security monitor and response system, 3:21219 (PB-269346)
**FISSION PRODUCTS/RADIATION MONITORING**
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457, 3:22224 (N-77-26934)
**FISSIONABLE MATERIALS MANAGEMENT**
*See NUCLEAR MATERIALS MANAGEMENT*
**FLAMES/SAMPLING**
Direct sampling and characterization of gaseous species responsible for fireside corrosion in fossil fuel-fired systems. Fourth quarterly progress report, January 1-March 31, 1977, 3:20928 (FE-2288-16)
**FLASHED STEAM SYSTEMS/STEAM TURBINES**
New industrial development of geothermal resources, 3:21440
**FLASKS**
*See CASKS*
**FLAT PLATE COLLECTORS/COST**
Solar collector cost reduction with reflector enhancement, 3:21382
**FLAT PLATE COLLECTORS/COVERINGS**
Cover for solar energy collectors (Patent), 3:21368
**FLAT PLATE COLLECTORS/DESIGN**
Design of flat reflector-collector combinations, 3:21377
**FLAT PLATE COLLECTORS/PERFORMANCE**
Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results, 3:21378
Enhancement of flat plate solar collector performance through the use of planar reflectors, 3:21380
Measurements on the effect of planar reflectors on the flux received by flat-plate collectors, 3:21379
**FLAT PLATE COLLECTORS/SOLAR REFLECTORS**
Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results, 3:21378
Design of flat reflector-collector combinations, 3:21377
Enhancement of flat plate solar collector performance through the use of planar reflectors, 3:21380
Measurements on the effect of planar reflectors on the flux received by flat-plate collectors, 3:21379
Solar collector cost reduction with reflector enhancement, 3:21382
**FLOW BLOCKAGE**
Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle (LMFBR), 3:21592 (JAPFNR-263)
**FLOWMETERS/CALIBRATION**
Signal analysis method using cross-correlation of turbulence flow signals to determine calibration of permanent magnet sodium flowmeters, 3:21579 (CONF-771023-23)
**FLUE GAS/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**FLUE GAS/CHEMICAL ANALYSIS**
Problem of determination of nitrogen oxides, 3:21007
**FLUE GAS/CLEANING**
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report, 3:20899 (EPRI-FP-291(Vol.1))
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:20900 (EPRI-FP-291(Vol.2))
Operation of an electroprecipitator influence of the main parameters, 3:21526
**FLUE GAS/DENITRATION**
Process for the removal of nitrogen oxides from flue gas, 3:20906
**FLUE GAS/DEW POINT**
Present relationships of sulfuric acid concentration to acid dewpoint for flue gases, 3:20905
**FLUE GAS/IONIZATION**
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report, 3:20899 (EPRI-FP-291(Vol.1))
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:20900 (EPRI-FP-291(Vol.2))
**FLUE GAS/PRODUCTION**
Conversion of biomass materials into gaseous products. Bimonthly technical status report, December 15, 1976-February 15, 1977, 3:21306 (CONF-770235-)
**FLUE GAS/PURIFICATION**
Process for the treatment of flue and waste gases (Patent), 3:20908
**FLUE GAS/SCRUBBING**
TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January-September 1976, 3:21525 (PB-269850)
**FLUIDIZED-BED COMBUSTION/ENVIRONMENTAL IMPACTS**
Preliminary environmental assessment of coal-fired fluidized-bed combustion systems. Preliminary report September 1975-June 1976, 3:20929 (PB-269556)
**FLUIDIZED-BED COMBUSTION/RESEARCH PROGRAMS**
Pressurized fluidized bed combustion. Quarterly technical progress report, January-March 1977, 3:20927 (FE-1511-39)
**FLUIDIZED-BED COMBUSTORS/DESIGN**
Pressurized fluidized-bed combustion combustion test and integration unit, PFBC/CTIU project. ANL monthly progress report, October 1977, 3:20923 (ANL/CTIU/FE-005)
**FLUIDIZED-BED COMBUSTORS/DUST COLLECTORS**
Analysis of the high-temperature particulate collection problem, 3:20922 (ANL-77-14)
**FLUIDIZED-BED COMBUSTORS/ECONOMICS**
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)
**FLUIDIZED-BED COMBUSTORS/EFFICIENCY**
Pressurized fluidized bed combustion. Quarterly technical progress report, January-March 1977, 3:20927 (FE-1511-39)
**FLUIDIZED-BED COMBUSTORS/OPERATION**
Fluidize to maximize, 3:22086
**FLUIDIZED-BED COMBUSTORS/PERFORMANCE**
Pollution control by incineration, 3:21850
**FLUIDIZED-BED COMBUSTORS/RELIABILITY**
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)
**FLUIDIZED-BED COMBUSTORS/USES**
Fluidize to maximize, 3:22086

**FLUORESCENCE SPECTROSCOPY/RESEARCH PROGRAMS**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**FLUORIDE VOLATILITY PROCESS/GAS CHROMATOGRAPHY**
In-line gas chromatograph for analysis of $UF_6$ and/or $F_2$, 3:21159
**FLUORIDES/ORDER-DISORDER TRANSFORMATIONS**
One-dimensional phonons and "phase-ordering" phase transition in a Hg-As-F compound, 3:21914
**FLUORIMETERS**
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr-77-86)
**FLUORINATED ALICYCLIC HYDROCARBONS/DECOMPOSITION**
Unimolecular decomposition of cyclo-$C_4F_8$ induced by a $CO_2$ TEA laser, 3:21989
**FLUORINATED ALICYCLIC HYDROCARBONS/PHOTOLYSIS**
Unimolecular decomposition of cyclo-$C_4F_8$ induced by a $CO_2$ TEA laser, 3:21989
**FLUORINATED ALIPHATIC HYDROCARBONS**
*See also CARBON TETRAFLUORIDE*
**FLUORINATED ALIPHATIC HYDROCARBONS/CHEMICAL REACTION YIELD**
Unimolecular decomposition of cyclo-$C_4F_8$ induced by a $CO_2$ TEA laser, 3:21989
**FLUORINATED ALIPHATIC HYDROCARBONS/DECOMPOSITION**
Unimolecular decomposition of cyclo-$C_4F_8$ induced by a $CO_2$ TEA laser, 3:21989
**FLUORINATED ALIPHATIC HYDROCARBONS/ELECTRONIC STRUCTURE**
Structure and energetics of simple carbenes $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$, 3:21981
**FLUORINE/CHEMICAL REACTIONS**
Reaction of fluorine and hypofluorous acid with some substitution-inert complex ions in aqueous perchloric acid solutions, 3:21959
**FLUORINE CHLORIDES**
*See CHLORINE FLUORIDES*
**FLUORINE IONS/ION-ATOM COLLISIONS**
Some features of the potential energy surfaces for the $F^+ + H_2$ ion-molecule reaction, 3:22321
**FLUX CORED ARC WELDING**
*See ARC WELDING*
**FLY ASH/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**FLY ASH/CHEMICAL ANALYSIS**
Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977-July 31, 1977, 3:20901 (FE-2205-8)
**FLY ASH/CHLORINATION**
Aluminum recovery from coal fly ash by high temperature chlorination, 3:20903 (IS-T-777)
**FLY ASH/ELECTRIC CONDUCTIVITY**
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume I. Final report, 3:20899 (EPRI-FP-291(Vol.1))
Development program for an ionizer-precipitator fine particle dust collection system as applied to coal-fired utility steam generators. Volume II. Final report, 3:20900 (EPRI-FP-291(Vol.2))
**FLY ASH/SAMPLING**
Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977-July 31, 1977, 3:20901 (FE-2205-8)
**FLY ASH/WASTE PRODUCT UTILIZATION**
Aluminum recovery from coal fly ash by high temperature chlorination, 3:20903 (IS-T-777)
Phase state of ash remainders of residual fuel oil, 3:21844
**FLYWHEELS/RESEARCH PROGRAMS**
Evaluation of selected drive components for a flywheel powered commuter vehicle. Phase I. Final report, 3:21858 (SAN/1164-1)
**FLYWHEELS/USES**
Utilization of flywheels for the evolution of high-performance electric vehicles, 3:21857 (UCRL-52346)
**FOAMS/MANUFACTURING**
Development of an automated foam processing system. Final report, 3:21910 (BDX-613-1691(Rev.))
**FOAMS/QUALITY CONTROL**
Development of an automated foam processing system. Final report, 3:21910 (BDX-613-1691(Rev.))
**FOOD**
*See also MILK*
**FOOD/RADIOMETRIC ANALYSIS**
Analyses of quality control samples at EML and a contractor laboratory during 1977 (Samples of bone, food, tap water and fallout $^{90}Sr$, $^{137}Cs$), 3:22143 (EML-334)
**FOOD CHAINS/CONTAMINATION**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208
**FOOD CHAINS/RADIONUCLIDE KINETICS**
Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971-1975, 3:22207 (PNL-2383)
**FOOD INDUSTRY/ENERGY CONSUMPTION**
Energy efficiency improvement targets. Food and kindred products industry (SIC 20). Volume 1. Draft target support document, 3:21820 (PB-269830)
Energy efficiency improvement targets. food and kindred products industry (SIC 20). Volume 2. Appendix report. Part 1, 3:21821 (PB-269831)
Energy efficiency improvement targets. Food and kindred products industry (SIC 20). Volume 3. Appendix report. Part 2, 3:21822 (PB-269832)
**FOOD INDUSTRY/ENERGY EFFICIENCY**
Energy policy and research: discussion from the ERDA perspective, 3:21699
**FOOD INDUSTRY/POWER DEMAND**
Agriculture and energy use in the year 2000: discussion from a natural resource perspective, 3:21717
**FOOD INDUSTRY/RESEARCH PROGRAMS**
Energy policy and research: discussion from the USDA perspective, 3:21698
Energy policy and research: discussion from the ERDA perspective, 3:21699
**FOOD INDUSTRY/TECHNOLOGY TRANSFER**
Energy policy and research: discussion from the USDA perspective, 3:21698
**FOOD INDUSTRY/WASTE DISPOSAL**
Single cell protein and other food recovery technologies from waste. Final report March-September 1976, 3:21841 (PB-270085)
**FORMIC ACID/LIQUID COLUMN CHROMATOGRAPHY**
Concentration and quantitative determination of trace volatile fatty acids in water by liquid chromatography with thermal detector, 3:21931 (BNWL-tr-279)
**FORSCHUNGSREAKTOR MUENCHEN**
*See FRM REACTOR*
**FORT ST. VRAIN REACTOR**
*See VRAIN REACTOR*
**FOSSIL FUELS**
*See also COAL*
*KEROSENE*
*NATURAL GAS*
*PETROLEUM*
*SYNTHETIC FUELS*
**FOSSIL FUELS/COMBUSTION**
Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis (Environmental pollution during fossil fuel combustion), 3:22276 (EML-334)
**FOSSIL FUELS/MEETINGS**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**FOSSIL-FUEL POWER PLANTS/BOILERS**
Investigation of slghtly nonisothermal models of recirculation of gases into the top part of furnace chambers of high-capacity boilers, 3:21494
Present-day problems of boiler engineering, 3:21492
**FOSSIL-FUEL POWER PLANTS/CHEMICAL EFFLUENTS**
Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants, 3:22196
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**FOSSIL-FUEL POWER PLANTS/COAL**
Status of coal supply contracts for new electric generating units, 1976-1985, 3:21727 (TID-28066)
**FOSSIL-FUEL POWER PLANTS/COAL PREPARATION**
Determining the efficiency of p.f. preparation under conditions of varying load of a generating unit, 3:20919
**FOSSIL-FUEL POWER PLANTS/COMBUSTORS**
On heat transmission in radiation combustion chambers by heaters, 3:21516 (DOE-tr-30)
**FOSSIL-FUEL POWER PLANTS/CONSTRUCTION**
Coal is the only solution, 3:21464
Design concept of large coal-fired power plants, 3:21465
**FOSSIL-FUEL POWER PLANTS/COST**
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N-77-26628)
Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report, 3:21474 (N-77-26630)
Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report, 3:21475 (N-77-26631)

Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report, 3:21476 (N-77-26632)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report, 3:21477 (N-77-26633)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. Part 3: open cycle gas turbines and open cycle MHD. Final report, 3:21478 (N-77-26634)

**FOSSIL-FUEL POWER PLANTS/COST BENEFIT ANALYSIS**
Is the trend of building giant units of power plants justified, 3:21466

**FOSSIL-FUEL POWER PLANTS/DESIGN**
Design concept of large coal-fired power plants, 3:21465
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N-77-26628)
Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report, 3:21474 (N-77-26630)
Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report, 3:21475 (N-77-26631)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report, 3:21476 (N-77-26632)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report, 3:21477 (N-77-26633)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. Part 3: open cycle gas turbines and open cycle MHD. Final report, 3:21478 (N-77-26634)
Is the trend of building giant units of power plants justified, 3:21466

**FOSSIL-FUEL POWER PLANTS/ECONOMETRICS**
Is the development of large power plant units reasonable, 3:21520

**FOSSIL-FUEL POWER PLANTS/ECONOMICS**
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)

**FOSSIL-FUEL POWER PLANTS/EFFICIENCY**
Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report, 3:21474 (N-77-26630)
Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report, 3:21475 (N-77-26631)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report, 3:21476 (N-77-26632)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report, 3:21477 (N-77-26633)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. Part 3: open cycle gas turbines and open cycle MHD. Final report, 3:21478 (N-77-26634)

**FOSSIL-FUEL POWER PLANTS/ENVIRONMENTAL IMPACTS**
Agriculture and energy use in the year 2000: discussion from a natural resource perspective, 3:21717
Energy conversion alternatives study (ECAS), phase 2. Volume 3: summary and advanced steam plant with pressurized fluidized bed boilers. Final report, 3:21474 (N-77-26630)
Energy conversion alternatives study (ECAS), phase 2. Volume 1: executive summary. Final report, 3:21475 (N-77-26631)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems, - conceptual designs. Part 1: analytical approach. Final report, 3:21476 (N-77-26632)
Energy conversion alternatives study (ECAS), phase 2. Volume 2: advanced energy conversion systems - conceptual designs. part 2: closed turbine cycles. Final report, 3:21477 (N-77-26633)

**FOSSIL-FUEL POWER PLANTS/FLY ASH**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977-July 31, 1977, 3:20901 (FE-2205-8)

**FOSSIL-FUEL POWER PLANTS/FUEL FEEDING SYSTEMS**
In-plant coal and ash handling overview, 3:21484 (CONF-770658-)

**FOSSIL-FUEL POWER PLANTS/FUEL SUBSTITUTION**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)

**FOSSIL-FUEL POWER PLANTS/GAS TURBINES**
Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan, 3:21485 (FE-2292-9)

**FOSSIL-FUEL POWER PLANTS/MODIFICATIONS**
Extension of the power plant mehrum by an additional 700 MW unit, 3:21487

**FOSSIL-FUEL POWER PLANTS/PERFORMANCE**
Energy conversion alternatives study (ECAS), Phase 2. Volume 1: summary and combined gas steam turbine plant with an integrated low-btu gasifier. Final report, 3:21473 (N-77-26628)

**FOSSIL-FUEL POWER PLANTS/PLANNING**
Concept of large power plants fired with bituminous coal, 3:21463
Industry in national planning: the power industry (1985 and 20005), 3:21742 (SIND-PM-1977-3)

**FOSSIL-FUEL POWER PLANTS/POLLUTION CONTROL EQUIPMENT**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)

**FOSSIL-FUEL POWER PLANTS/RADIOACTIVE EFFLUENTS**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))

**FOSSIL-FUEL POWER PLANTS/RELIABILITY**
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)

**FOSSIL-FUEL POWER PLANTS/SCRUBBERS**
TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January-September 1976, 3:21525 (PB-269850)

**FOSSIL-FUEL POWER PLANTS/SITE SELECTION**
Electric power transport or coal transport - where to build new stone coal power plants, 3:21528

**FOSSIL-FUEL POWER PLANTS/SPECIFICATIONS**
Concept of large power plants fired with bituminous coal, 3:21463

**FOSSIL-FUEL POWER PLANTS/SUPERHEATERS**
Some problems of control of intermediate superheating of steam, 3:21495

**FOSSIL-FUEL POWER PLANTS/THERMAL EFFLUENTS**
Thermal impact assessment of multi-power plant operations on estuaries, 3:22229

**FOSSIL-FUEL POWER PLANTS/WASTE HEAT UTILIZATION**
Coal is the only solution, 3:21464

**FOUNDRIES/FUEL ECONOMY**
Energy profile and reduction of specific energy consumption in foundries, 3:21833

**FRANCE/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))

**FRANCE/ENERGY CONSERVATION**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)

**FRANCE/ENERGY POLICY**
Contribution to the general discussion by delegate from France (France's positive stand for nuclear energy), 3:21704 (CONF-770971-1)

**FRANCE/GEOTHERMAL RESOURCES**
Perspectives on geothermal energy in France, 3:21396

**FRANCIUM 215/NUCLEAR STRUCTURE**
Nuclear data sheets for A=215, 3:22372

**FRANCIUM 219/NUCLEAR STRUCTURE**
Nuclear data sheets for A=219, 3:22373

**FRANCIUM 227/NUCLEAR STRUCTURE**
Nuclear data sheets for A=227, 3:22377

**FRESH WATER ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*

**FRESNEL LENS/DATA ACQUISITION**
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report, 3:21369 (N-77-26610)

**FRESNEL LENS/RESEARCH PROGRAMS**
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator. Final report, 3:21369 (N-77-26610)

**FRM REACTOR/ALPHA REACTIONS**
Alpha particle effects on the reversal field mirror, 3:22417

**FTR REACTOR**
*See FFTF REACTOR*

**FUEL BUNDLES**
*See FUEL ELEMENT CLUSTERS*

**FUEL CANS/PHYSICAL RADIATION EFFECTS**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report (BWR, PWR), 3:21556 (EPRI-NP-567)

**FUEL CANS/STRESS CORROSION**
Stress corrosion cracking of Zircaloy-2 cladding in iodine vapor, 3:21616

**FUEL CANS/TENSILE PROPERTIES**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report (BWR, PWR), 3:21556 (EPRI-NP-567)

**FUEL CELLS**
*See also ACID ELECTROLYTE FUEL CELLS*
**FUEL CELLS/DESIGN**
Fuel cell (Patent), 3:21769
Off-peak energy storage concept for electric utilities: Part I. Electric utility requirements, 3:21521
**FUEL CELLS/LIQUID FLOW**
Fuel cell (Patent), 3:21769
**FUEL CYCLE**
Low-enrichment and mid-enrichment denatured (thorium) fuels for the HTGR: a feasibility study. Final report, 3:21573 (GA-A-14684)
**FUEL CYCLE/CHEMICAL EFFLUENTS**
Effluents from the LWR stowaway fuel cycle, 3:21203
ENFORM fuel cycle effluents model, 3:21204
Environmental assessment methodology for the nuclear fuel cycle, 3:21205
**FUEL CYCLE/ENVIRONMENTAL IMPACTS**
Effluents from the LWR stowaway fuel cycle, 3:21203
ENFORM fuel cycle effluents model, 3:21204
Environmental assessment methodology for the nuclear fuel cycle, 3:21205
**FUEL CYCLE/RADIOACTIVE EFFLUENTS**
Effluents from the LWR stowaway fuel cycle, 3:21203
ENFORM fuel cycle effluents model, 3:21204
Environmental assessment methodology for the nuclear fuel cycle, 3:21205
**FUEL CYCLE/SAFEGUARDS**
Denatured fuel cycles for safeguards control, 3:21233
**FUEL ELEMENT CLUSTERS/FLOW BLOCKAGE**
Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle (LMFBR), 3:21592 (JAPFNR-263)
**FUEL ELEMENT CLUSTERS/LOSS OF FLOW**
Transient boiling of sodium in a 19-pin bundle under loss-of-flow conditions, 3:21658 (JAPFNR-262)
**FUEL ELEMENTS**
*See also FUEL CANS*
*NUCLEAR FUELS*
*SPENT FUEL ELEMENTS*
**FUEL ELEMENTS/HEAT TRANSFER**
Methods and correlations for the prediction of quenching rates on hot surfaces (Reactor fuel elements), 3:21615
**FUEL ELEMENTS/PERFORMANCE TESTING**
Postirradiation examination results for the Irradiation Effects Test Series IE-ST-2, Rod IE-002 (PWR), 3:21563 (TREE-NUREG-1177)
**FUEL ELEMENTS/QUENCHING**
Methods and correlations for the prediction of quenching rates on hot surfaces (Reactor fuel elements), 3:21615
**FUEL ELEMENTS/THERMAL CONDUCTIVITY**
Experimental determination of thermal conductivity coefficient of $UO_2$ and fuel cladding contact conduction in fuel elements under reactor irradiation, 3:21902 (NIIAR-P-250)
**FUEL FABRICATION PLANTS/CRITICALITY**
Criticality considerations for $^{233}U$ fuels in an HTGR fuel refabrication facility, 3:21144 (ORNL/TM-6136)
**FUEL FABRICATION PLANTS/RADIOACTIVE WASTE PROCESSING**
Method and device for the dry preparation of ceramic uranium dioxide nuclear fuel wastes (Patent), 3:21148
**FUEL FEEDING SYSTEMS/COMPARATIVE EVALUATIONS**
Coal pump development and technical support. Quarterly project report. Report No. 2, 3:20852 (DOE/JPL/2616-2)
**FUEL FEEDING SYSTEMS/DESIGN**
Coal firing technology for existing side fired tunnel kilns, 3:21807 (CONF-770658-)
**FUEL GAS**
*See also HIGH BTU GAS*
**FUEL GAS/CALORIFIC VALUE**
Note on underground coal gasification, 3:20873
**FUEL GAS/COST**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**FUEL GAS/PURIFICATION**
Granular bed filter development program: particle sampling facility operation, 3:20902 (FE-2579-10)
**FUEL GAS/SYNTHESIS**
Development program for MHD power generation: coal devolatilization. Final report, Volume VI, July 1, 1975-September 30, 1976 (Exhaust gas from MHD generator used to pyrolyze coal for production of clean fuel gas of CO and H2), 3:20855 (FE-2015-20)
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**FUEL OILS**
*See also HEATING OILS*
*RESIDUAL FUELS*
**FUEL OILS/ADDITIVES**
Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils, 3:21049
**FUEL OILS/COMBUSTION**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977 (Coal-oil-water slurries), 3:20889 (FE-2030-8)
**FUEL OILS/COMBUSTION PRODUCTS**
Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils, 3:21049
Phase state of ash remainders of residual fuel oil, 3:21844
**FUEL OILS/COMBUSTION PROPERTIES**
General Motors powdered coal-oil project, 3:20925 (CONF-770658-)
Pittsburgh Energy Research Center (PERC) combustion support program, 3:20926 (CONF-770658-)
**FUEL OILS/DENSITY**
Experimental investigation of the density of residual fuel oil of Tyumen deposit petroleum types, 3:21041
**FUEL OILS/PHYSICAL PROPERTIES**
Experimental investigation of the density of residual fuel oil of Tyumen deposit petroleum types, 3:21041
**FUEL OILS/TOXICITY**
Effects of water soluble extracts of oil on phytoplankton, 3:22271 (CONF-730386-)
**FUEL PELLETS/TEMPERATURE GRADIENTS**
Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient, 3:21149
**FUEL REPROCESSING PLANTS/MATERIALS**
Applying hafnium or hafnium alloys as material in plants for reprocessing irradiated nuclear fuels (Patent), 3:21161
**FUEL REPROCESSING PLANTS/NUCLEAR MATERIALS MANAGEMENT**
Nondestructive analysis methods for the measurement of special nuclear materials, 3:21229
**FUEL REPROCESSING PLANTS/PROCESS CONTROL**
Remotely controlled computer-guided preparation facility for X-ray fluorescence measurement samples at a fuel reprocessing plant, 3:21156
**FUEL REPROCESSING PLANTS/RADIOACTIVE WASTE DISPOSAL**
Chemistry of nuclear waste disposal, 3:21194
**FUEL REPROCESSING PLANTS/RADIOACTIVE WASTE PROCESSING**
Topical problems in reprocessing nuclear fuels, 3:21157
**FUEL REPROCESSING PLANTS/SAFEGUARDS**
Joint ERDA-NRC task force on safeguards. Final report, July 12, 1976, 3:21218 (ERDA-77-34)
Safetguards planning in a plant design process, 3:21228
**FUEL SLURRIES/COMBUSTION**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977 (Coal-oil-water slurries), 3:20889 (FE-2030-8)
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**FUEL SUBSTITUTION/ENVIRONMENTAL IMPACTS**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB-269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB-269366)
**FUEL SUBSTITUTION/INDUSTRIAL PLANTS**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB-269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB-269366)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS, 3:21815 (PB-269367)
**FUEL SUBSTITUTION/MEETINGS**
Proceedings of the fuel switching forum, 3:20924 (CONF-770658-)
**FUEL-COOLANT INTERACTIONS/PRESSURE GRADIENTS**
Evaluation of effects of finite mixing time and non-condensable gas on fuel-sodium interactions, 3:21656
**FUELS**
*See also AUTOMOTIVE FUELS*
*AVIATION FUELS*
*FOSSIL FUELS*
*FUEL GAS*
*JET ENGINE FUELS*
*NUCLEAR FUELS*
*REFUSE DERIVED FUELS*
*SOLVENT-REFINED COAL*
*SYNTHETIC FUELS*
*THERMONUCLEAR FUELS*

**FUELS/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**FUELS/ECONOMICS**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**FUMES**
*See AEROSOLS*
**FUMIGANTS/BIOLOGICAL EFFECTS**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**FUNDAMENTAL PARTICLES**
*See ELEMENTARY PARTICLES*
**FUNGI/METABOLISM**
Microbial petroleum degradation: the role of cladosporium resinae (Cladosporium resinae), 3:22274 (CONF-730386-)
**FURNACES**
*See also ARC FURNACES*
*BLAST FURNACES*
*ELECTRON BEAM FURNACES*
*GAS FURNACES*
*GAS GENERATORS*
*WOOD BURNING FURNACES*
**FURNACES/CONTROL SYSTEMS**
Optimalizing control of firing conditions in the furnace of drum-type steam generators, 3:21509
**FURNACES/FUEL ECONOMY**
How to decrease the energy demand of powder metallurgy furnaces, 3:21832
**FURNACES/OPERATION**
Experiences in direct firing of glass furnaces, Columbine Glass, 3:21808 (CONF-770658-)
**FUSION REACTORS**
*See THERMONUCLEAR REACTORS*

## G

**GADOLINIUM/SELF-DIFFUSION**
Anomalous self-diffusion in rare earths and actinides, 3:21892
**GALLIUM ALLOYS/CHEMICAL PREPARATION**
Solid-state (bronze process) $V_3Ga$ from a V-Al alloy core, 3:21885
**GALLIUM ALLOYS/SUPERCONDUCTIVITY**
Solid-state (bronze process) $V_3Ga$ from a V-Al alloy core, 3:21885
**GALLIUM ARSENIDE SOLAR CELLS/FABRICATION**
Feasibility investigations of growing and characterizing gallium arsenide crystals in ribbon form. Semi-annual progress report 1 January-30 June 1975, 3:21280 (PB-269587)
Growth and characterization of VPE thin-film AlAs-GaAs heterojunction layers, 3:21300
**GALLIUM ARSENIDE SOLAR CELLS/SCHOTTKY EFFECT**
Back wall Schottky barrier solar cell with an interfacial layer, 3:21288
**GALLIUM ARSENIDES/CRYSTAL GROWTH**
Feasibility investigations of growing and characterizing gallium arsenide crystals in ribbon form. Semi-annual progress report 1 January-30 June 1975, 3:21280 (PB-269587)
**GALLIUM ARSENIDES/MEETINGS**
Gallium arsenide and related compounds (Edinburgh), 1976, 3:22056
Gallium arsenide and related compounds (St. Louis), 1976, 3:22061
**GALLIUM ARSENIDES/VAPOR PLATING**
Growth and characterization of VPE thin-film AlAs-GaAs heterojunction layers, 3:21300
**GAMMA CAMERAS**
*See also POSITRON CAMERAS*
**GAMMA CAMERAS/PERFORMANCE TESTING**
Field procedure for quantitative assessment of gamma cameras, 3:22123
**GAMMA DETECTION**
Instrumentation use in the uranium mill tailings program in Colorado, 3:22182 (HASL-325)
**GAMMA SOURCES**
*(See also specific radioisotopes.)*
*See also COSMIC GAMMA SOURCES*
**GAMMA SOURCES/BIOLOGICAL RADIATION EFFECTS**
Basic aspects of radiation action on microorganisms. Final report for the period ending October 31, 1977 (Radioresistance of micrococcus luteus), 3:22252 (COO-2362-27)
**GAMMA SOURCES/ENERGY SPECTRA**
Exposure spectra from NBS vertical-beam $^{60}Co$ gamma-ray source. Final report, 3:21238 (PB-269341)
**GAMMA SOURCES/GENETIC RADIATION EFFECTS**
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967-September 1977, 3:22264 (COO-38-1838)
**GAMMA SOURCES/RADIATION MONITORING**
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**GAMMA TRANSPORT THEORY/COMPUTER CODES**
User's manual for the CDC-6600 version of AMPX, 3:22385 (SAND-77-1148)
**GARDENHOSE INSTABILITY**
*See HOSE INSTABILITY*
**GAS CONDENSATE FIELDS**
Oil and gas separation on inclined shelves, 3:20969
**GAS COOLANTS**
*See GASES*
**GAS COOLED FAST BREEDER REACTOR**
*See GCFR REACTOR*
**GAS ENGINES**
*See INTERNAL COMBUSTION ENGINES*
**GAS FLOW**
Bush Dome model computing movement of injected crude helium. General instruction manual for computer program KWDX-577-mp for computing gas movement in a gas storage reservoir. Final report, 3:21691 (PB-269451)
**GAS FURNACES/RADIANT HEAT TRANSFER**
Calculation of radiative heat transfer in a large gas fired furnace, 3:22089
**GAS GENERATORS/DESIGN**
Ignition process for downhole gas generator (Patent), 3:20960
**GAS GENERATORS/MATERIALS**
Metallographic and chemical analyses of a plain carbon steel plate after long term service in a coal gasifier, 3:20871
**GAS LASERS**
*See also CARBON DIOXIDE LASERS*
*CARBON MONOXIDE LASERS*
*HELIUM-NEON LASERS*
**GAS LASERS/DESIGN**
Gasdynamic laser using a $D_2$-HCl-He mixture, 3:22041
**GAS LASERS/ELECTRIC DISCHARGES**
Argon laser with wall stabilized transverse discharge, 3:22038
**GAS LASERS/ENERGY YIELD**
Investigation of the energy characteristics of a copper vapor laser with a longitudinal discharge, 3:22050
**GAS LASERS/ENERGY-LEVEL TRANSITIONS**
Further assignments for the far-infrared laser transitions of HCN and $HC^{15}N$, 3:22033
**GAS LASERS/EXCITATION**
Stimulated emission at 9.75 μm following two-photon excitation of methyl fluoride, 3:22028
**GAS LASERS/GAIN**
Gasdynamic laser using a $D_2$-HCl-He mixture, 3:22041
**GAS LASERS/GLOW DISCHARGES**
Laser discharges in attaching gases, June 25, 1976-June 24, 1977. Final report, 3:22018 (COO-4030-4)
**GAS LASERS/KINETIC EQUATIONS**
Kinetics of stimulated emission of excimer radiation from inert gases in a nonself-sustained electric discharge, 3:22042
**GAS LASERS/NUCLEAR PUMPING**
Direct nuclear-pumped laser approaching feedback laser fusion needs, 3:22673
Nuclear pumped laser. II. Final contractor report, August 1975-August 1977, 3:22021 (N-77-26479)
**GAS LASERS/OPTICAL PUMPING**
High-power pulse $NH_3$ laser pumped optically by $CO_2$ laser radiation, 3:22048
Optically pumped molecular lasers in the 11-17-μm region, 3:22035
**GAS LASERS/PERFORMANCE**
Experimental determination of the contrast of two interfering argon laser beams, 3:22022 (N-77-26490)
Fluorescence-pumped selenium photolytic gas laser system for a commercial laser fusion power plant, 3:22664
Scaling a double-pulsed copper chloride laser to 10 mJ, 3:22034
**GAS LASERS/PERFORMANCE TESTING**
Tunable single-frequency calcium-hydrogen laser emitting at 5.54 μ, 3:22052
**GAS LASERS/STIMULATED EMISSION**
Kinetics of stimulated emission of excimer radiation from inert gases in a nonself-sustained electric discharge, 3:22042
**GAS LASERS/TUNING**
Spectral tuning of ArF and KrF discharge lasers, 3:22031
**GAS OILS/PURIFICATION**
High-v.i. lubricating oil produced by adsorptive treatment of heavy catalytic gas oil, 3:21001
**GAS TURBINES/COMBUSTORS**
Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan, 3:21485 (FE-2292-9)
Experimental study on the emissions of a model gas turbine combustor, 3:21866
Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission, 3:21867

**GAS TURBINES/EXHAUST GASES**
Experimental study on the emissions of a model gas turbine combustor, 3:21866
Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission, 3:21867
**GAS TURBINES/TECHNOLOGY ASSESSMENT**
Development of high-temperature subsystem technology to a technology readiness state. Phase I. Topical report. Phase 2. Technology development plan, 3:21485 (FE-2292-9)
**GAS TURBINES/TRANSIENTS**
Investigation of the transient conditions of operation of the GT-100-750-2 gas turbines, 3:21507
**GASEOUS WASTES**
*See also FLUE GAS*
*OFF-GAS SYSTEMS*
**GASEOUS WASTES/DENITRATION**
Process for separation of nitrogen oxides from waste gas (Patent), 3:20907
**GASEOUS WASTES/PURIFICATION**
Method of removing sulfur dioxide from a gas, 3:20909
Process for the treatment of flue and waste gases (Patent), 3:20908
**GASES**
*See also AIR*
*COAL GAS*
*NATURAL GAS*
**GASES/COMBUSTION KINETICS**
Computational aspects of Glimm's method, 3:22000 (LBL-7228)
**GAS-INSULATED CABLES**
Welded pipe line system, insulated by sulfur hexafluoride, made of an aluminium alloy, for power transmission, 3:21533
**GAS-INSULATED CABLES/DESIGN**
Study of gas dielectrics for cable insulation. Final report, 3:21549 (EPRI-EL-220)
**GAS-INSULATED CABLES/PERFORMANCE**
Study of gas dielectrics for cable insulation. Final report, 3:21549 (EPRI-EL-220)
**GASOLINE**
*See also MOBIL M-GASOLINE PROCESS*
**GASOLINE/ALLOCATIONS**
Findings and views concerning the exemption of motor gasoline from the mandatory petroleum allocation and price regulations. Final report, 3:21035 (TID-28102)
**GASOLINE/REGULATIONS**
Findings and views concerning the exemption of motor gasoline from the mandatory petroleum allocation and price regulations. Final report, 3:21035 (TID-28102)
**GASOLINE/SYNTHESIS**
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October-December 1976, 3:21257 (FE-2276-6)
Early coal hydrogenation catalysis, 3:20883
**GASTEROPODS**
*See MOLLUSCS*
**GCFR REACTOR/DESIGN**
Gas-Cooled Fast Breeder Reactor. Quarterly progress report, August 1, 1977-October 31, 1977 (Core assembly; fuels and materials; thermohydraulics; kinetics; shielding; systems and components; safety), 3:21584 (GA-A-14613)
**GCFR REACTOR/ENGINEERING**
Gas-Cooled Fast Breeder Reactor. Quarterly progress report, August 1, 1977-October 31, 1977 (Core assembly; fuels and materials; thermohydraulics; kinetics; shielding; systems and components; safety), 3:21584 (GA-A-14613)
**GCFR REACTOR/REACTOR CORES**
Static test of the gas-cooled fast breeder reactor core support grid plate: comparison of experimental, analytical, and finite-element models, 3:21583 (GA-A-14121)
**GENERATORS (ELECTRIC)**
*See ELECTRIC GENERATORS*
**GENERATORS (STEAM)**
*See STEAM GENERATORS*
**GEOCHEMICAL SURVEYS/MANUALS**
Field manual for stream water and sediment reconnaissance, 3:21119 (DPST-77-363)
**GEOLOGIC STRATA/PERMEABILITY**
Effect of pressure variation in a stratum on hydrodynamic characteristics of neighboring strata, 3:22285
**GEOLOGIC STRUCTURES/GEOLOGICAL SURVEYS**
Structure of the Naturaliste Plateau and Trough, 3:20944
**GEOLOGIC STRUCTURES/GRAVITY SURVEYS**
Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau, 3:22284
**GEOLOGIC STRUCTURES/MAGNETIC SURVEYS**
Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau, 3:22284
**GEOLOGIC STRUCTURES/SEISMIC SURVEYS**
Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau, 3:22284
**GEOLOGIC STRUCTURES/STRATIGRAPHY**
Structure of the Naturaliste Plateau and Trough, 3:20944
Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau, 3:22284
**GEOPRESSURED SYSTEMS**
100,000 quads of natural gas, 3:21061 (HI-2451/3-P)
**GEOPRESSURED SYSTEMS/GEOPHYSICAL SURVEYS**
Occurrence, prediction and control of geopressures on the northwest shelf of Australia, 3:20978
**GEOPRESSURED SYSTEMS/WELL DRILLING**
Occurrence, prediction and control of geopressures on the northwest shelf of Australia, 3:20978
**GEORGIA/PUBLIC UTILITIES**
Utility rules of the Georgia Public Service Commission, effective January 1, 1976, 3:21848 (PB-269420)
**GEOTHERMAL ENERGY/BIBLIOGRAPHIES**
Geothermal energy. Volume 1. Search period covered: 1970-1974. Citations from the Engineering Index Data Base, 3:21390
Legal and institutional impediments to geothermal energy resource development: a bibliography, 3:21413 (TID-3365)
**GEOTHERMAL ENERGY/ECONOMICS**
Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power, 3:21427 (SAN-115P108-1(Vol.2))
Economic analyses of geothermal energy development in California, 3:21428 (SAN-115P108-1(Vol.1))
**GEOTHERMAL ENERGY/ENERGY SOURCE DEVELOPMENT**
Institutional barriers to geothermal energy development. A report by the Institutional Barrier Panel to the Geothermal Advisory Council, 3:21421
Regulatory, planning and policy aspects of geothermal energy development in Imperial County, California, 3:21415
**GEOTHERMAL ENERGY/ENVIRONMENTAL EFFECTS**
Institutional and environmental aspects of geothermal energy development, 3:21414
**GEOTHERMAL ENERGY/ENVIRONMENTAL IMPACTS**
Environmental aspects of geothermal energy, 3:21434
Geographical environmental analysis. Final report, 3:21419
**GEOTHERMAL ENERGY/FINANCIAL INCENTIVES**
Benefits of stimulating geothermal energy development with tax and research subsidies, 3:21422
**GEOTHERMAL ENERGY/FINANCING**
Legal, institutional, and political problems in producing electric power from geothermal resources in California, 3:21423
**GEOTHERMAL ENERGY/GOVERNMENT POLICIES**
Recent developments in geothermal energy, 3:21438
Regulatory, planning and policy aspects of geothermal energy development in Imperial County, California, 3:21415
**GEOTHERMAL ENERGY/LEGAL ASPECTS**
Institutional barriers to geothermal energy development. Second report of the Institutional Barrier Panel to the Geothermal Advisory Council, 3:21420
Institutional and environmental aspects of geothermal energy development, 3:21414
Legal and institutional impediments to geothermal energy resource development: a bibliography, 3:21413 (TID-3365)
Legal and institutional factors. Geothermal research study in the Salton Sea region of California, 3:21424
**GEOTHERMAL ENERGY/POWER GENERATION**
Present and future status of geothermal power generation in Japan and abroad, 3:21398
**GEOTHERMAL ENERGY/REGULATIONS**
Institutional barriers to geothermal energy development. A report by the Institutional Barrier Panel to the Geothermal Advisory Council, 3:21421
Regulatory, planning and policy aspects of geothermal energy development in Imperial County, California, 3:21415
**GEOTHERMAL ENERGY/RESEARCH PROGRAMS**
Status of ERDA geothermal program and recent developments, 3:21389
**GEOTHERMAL ENERGY/REVIEWS**
Geothermal power emerging as an alternate energy source, 3:21391
Present and future status of geothermal power generation in Japan and abroad, 3:21398
**GEOTHERMAL ENERGY/TECHNOLOGY ASSESSMENT**
Recent developments in geothermal energy, 3:21438
Technical issues in geothermal power development, 3:21436
**GEOTHERMAL EXPLORATION**
Mobile helium sniffer for petroleum, uranium and geothermal prospecting, 3:21136
**GEOTHERMAL EXPLORATION/BASELINE ECOLOGY**
Geothermal Environmental Advisory Panel. Second annual report, July 1, 1975-June 30, 1976 (Preparation of guidelines for industry compliance with environmental monitoring), 3:21435

**GEOTHERMAL EXPLORATION/BIBLIOGRAPHIES**
Geothermal energy. Volume 1. Search period covered: 1970-1974. Citations from the Engineering Index Data Base, 3:21390
**GEOTHERMAL EXPLORATION/COST**
Processes of heat accumulation and geothermal resource formation, 3:21451
**GEOTHERMAL EXPLORATION/ENVIRONMENTAL EFFECTS**
Geothermal Environmental Advisory Panel. Second annual report, July 1, 1975-June 30, 1976 (Preparation of guidelines for industry compliance with environmental monitoring), 3:21435
**GEOTHERMAL EXPLORATION/GEOCHEMICAL SURVEYS**
Studies of deep, widespread geothermal resources, 3:21409
**GEOTHERMAL EXPLORATION/GEOPHYSICAL SURVEYS**
Studies of deep, widespread geothermal resources, 3:21409
**GEOTHERMAL EXPLORATION/REMOTE SENSING**
Geological remote sensing-evaluation of image data, 3:21408
Studies of deep, widespread geothermal resources, 3:21409
**GEOTHERMAL EXPLORATION/REVIEWS**
Processes of heat accumulation and geothermal resource formation, 3:21451
**GEOTHERMAL FIELDS**
*See also EAST MESA GEOTHERMAL FIELD*
*HEBER GEOTHERMAL FIELD*
*LARDERELLO GEOTHERMAL FIELD*
*SALTON SEA GEOTHERMAL FIELD*
*WAIRAKEI GEOTHERMAL FIELD*
**GEOTHERMAL FIELDS/BIBLIOGRAPHIES**
Geothermal energy. Volume 1. Search period covered: 1970-1974. Citations from the Engineering Index Data Base, 3:21390
**GEOTHERMAL FIELDS/ENVIRONMENTAL IMPACTS**
Geothermal resources operational Order No. 4: general environmental protection requirements, 3:21425
**GEOTHERMAL FIELDS/GEOLOGICAL SURVEYS**
Geological remote sensing-evaluation of image data, 3:21408
**GEOTHERMAL FIELDS/PIPELINES**
Geothermal resources operational Order No. 6: pipelines and surface production facilities, 3:21417
**GEOTHERMAL FIELDS/ROCKS**
Observation of rock using a heating microscope, 3:21456
**GEOTHERMAL FLUIDS/CORROSIVE EFFECTS**
Development of geothermal energy: some problems, 3:21447
**GEOTHERMAL FLUIDS/HEAT EXTRACTION**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**GEOTHERMAL FLUIDS/SCALING**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**GEOTHERMAL FLUIDS/TRANSPORT**
Plan for steam transport facilities at Kuzuneda geothermal power plant, 3:21446
**GEOTHERMAL INDUSTRY**
Structure of the geothermal industry through 1974, 3:21426
**GEOTHERMAL POWER PLANTS/COST BENEFIT ANALYSIS**
Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power, 3:21427 (SAN-115P108-1(Vol.2))
**GEOTHERMAL POWER PLANTS/DESIGN**
Heber Geothermal Demonstration Plant, 3:21437
Technical issues in geothermal power development, 3:21436
**GEOTHERMAL POWER PLANTS/ECONOMICS**
Economic analyses of geothermal energy development in California, 3:21428 (SAN-115P108-1(Vol.1))
**GEOTHERMAL POWER PLANTS/PIPES**
Piping facilities for geothermal power stations, 3:21445
Plan for steam transport facilities at Kuzuneda geothermal power plant, 3:21446
**GEOTHERMAL POWER PLANTS/PLANNING**
New industrial development of geothermal resources, 3:21440
**GEOTHERMAL POWER PLANTS/REVIEWS**
Present and future status of geothermal power generation in Japan and abroad, 3:21398
**GEOTHERMAL POWER PLANTS/THERMODYNAMIC CYCLES**
Outline of heat cycles and facilities for geothermal power generation, 3:21439
**GEOTHERMAL POWER PLANTS/VALVES**
Piping facilities for geothermal power stations, 3:21445
**GEOTHERMAL RESOURCES/BIBLIOGRAPHIES**
Geothermal energy. Volume 1. Search period covered: 1970-1974. Citations from the Engineering Index Data Base, 3:21390
**GEOTHERMAL RESOURCES/BY-PRODUCTS**
Geothermal resources operational Order No. 7: production and royalty measurement, equipment, and testing procedures, 3:21418
**GEOTHERMAL RESOURCES/ECONOMIC IMPACT**
Economic impact of geothermal energy development, 3:21429
Multisector analysis of the impact of geothermal development on the economy of Imperial County, California, 3:21430
**GEOTHERMAL RESOURCES/ENERGY SOURCE DEVELOPMENT**
Benefits of stimulating geothermal energy development with tax and research subsidies, 3:21422
Multisector analysis of the impact of geothermal development on the economy of Imperial County, California, 3:21430
Outlook for utility development of geothermal resources, 3:21392
**GEOTHERMAL RESOURCES/ENVIRONMENTAL IMPACTS**
Economic impact of geothermal energy development, 3:21429
Geothermal environmental overview project, 3:21433 (UCID-17632)
Geothermal resources operational Order No. 4: general environmental protection requirements, 3:21425
**GEOTHERMAL RESOURCES/INCOME**
Geothermal resources operational Order No. 7: production and royalty measurement, equipment, and testing procedures, 3:21418
**GEOTHERMAL RESOURCES/LAND LEASING**
Legal, institutional, and political problems in producing electric power from geothermal resources in California, 3:21423
Structure of the geothermal industry through 1974, 3:21426
**GEOTHERMAL RESOURCES/LEGAL ASPECTS**
Geothermal resources operational Order No. 4: general environmental protection requirements, 3:21425
Geothermal resources operational Order No. 6: pipelines and surface production facilities, 3:21417
Geothermal resources operational Order No. 7: production and royalty measurement, equipment, and testing procedures, 3:21418
Legal, institutional, and political problems in producing electric power from geothermal resources in California, 3:21423
**GEOTHERMAL RESOURCES/LEGISLATION**
Geothermal power emerging as an alternate energy source, 3:21391
**GEOTHERMAL RESOURCES/POWER POTENTIAL**
Outlook for utility development of geothermal resources, 3:21392
**GEOTHERMAL RESOURCES/PRODUCTION**
Geothermal resources operational Order No. 6: pipelines and surface production facilities, 3:21417
Geothermal resources operational Order No. 7: production and royalty measurement, equipment, and testing procedures, 3:21418
**GEOTHERMAL RESOURCES/REVIEWS**
Geothermal power emerging as an alternate energy source, 3:21391
**GEOTHERMAL RESOURCES/TAXES**
State taxation of geothermal resources compared with state taxation of other energy minerals, 3:21431
**GEOTHERMAL SPACE HEATING**
Perspectives on geothermal energy in France, 3:21396
**GEOTHERMAL SYSTEMS**
*See also GEOPRESSURED SYSTEMS*
*HOT-DRY-ROCK SYSTEMS*
*HYDROTHERMAL SYSTEMS*
*MAGMA SYSTEMS*
**GEOTHERMAL SYSTEMS/ORIGIN**
Processes of heat accumulation and geothermal resource formation, 3:21451
**GEOTHERMAL SYSTEMS/RESEARCH PROGRAMS**
Geothermal reservoir engineering management program plan (GREMP Plan), 3:21400 (LBL-7000)
**GEOTHERMAL SYSTEMS/RESERVOIR ENGINEERING**
Geothermal reservoir engineering management program plan (GREMP Plan), 3:21400 (LBL-7000)
**GEOTHERMAL WELLS/CEMENTS**
Studies of cement for geothermal power generation, 3:21444
**GEOTHERMAL WELLS/WELL CASINGS**
Casings for geothermal wells, 3:21443
**GEOTHERMAL WELLS/WELL DRILLING**
Petrological approach to development of geothermal energy, 3:21441
**GERMAN FEDERAL REPUBLIC/COAL INDUSTRY**
Mining within the energy economy of the Federal Republic in 1975, 3:20933
**GERMAN FEDERAL REPUBLIC/ECONOMY**
No uranium OPEC to be evoked as a phantom, 3:21747
**GERMAN FEDERAL REPUBLIC/ENERGY SUPPLIES**
Energy supply for the Federal Republic of Germany. Research and development for the energy supply, 3:21720
**GERMAN FEDERAL REPUBLIC/FUEL REPROCESSING PLANTS**
Fuel elements for nuclear reactors from the cased chemical plant. High safety requirements on the reprocessing plant, 3:21160
**GERMAN FEDERAL REPUBLIC/IN-SITU GASIFICATION**
In-situ coal gasification. Part of the energy research program of the Federal government, 3:20867

**GERMAN FEDERAL REPUBLIC/NATURAL GAS INDUSTRY**
Tendencies of technical and economic development in the public gas supply industry, 3:21089
**GERMAN FEDERAL REPUBLIC/POWER GENERATION**
No uranium OPEC to be evoked as a phantom, 3:21747
**GERMANIUM/LASER DRILLING**
Tunable-laser-induced grating dip for measuring sub-picosecond relaxation, 3:21916
**GERMANIUM/PHYSICAL RADIATION EFFECTS**
Capture of positrons by radiation defects in germanium, 3:21898
**GERMANIUM 70 TARGET/KRYPTON 86 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**GERMANIUM 74 TARGET/KRYPTON 86 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**GERMANIUM 76 TARGET/KRYPTON 86 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**GERMANIUM COMPLEXES/HYDROLYSIS**
Kinetic study of the hydrolysis of 2-germaacetate in neutral and alkaline solutions, 3:21958
**GERMANIUM COMPOUNDS/ELECTRONIC STRUCTURE**
Homopolyatomic anions and configurational questions. Synthesis and structure of the nonagermanide(2-) and nonagermanide(4-) ions, $Ge_9^{2-}$ and $Ge_9^{4-}$, 3:21964
**GERMANIUM COMPOUNDS/SYNTHESIS**
Homopolyatomic anions and configurational questions. Synthesis and structure of the nonagermanide(2-) and nonagermanide(4-) ions, $Ge_9^{2-}$ and $Ge_9^{4-}$, 3:21964
**GERMANY (FEDERAL REPUBLIC)**
*See GERMAN FEDERAL REPUBLIC*
**GEYSERS GEOTHERMAL FIELD/ENVIRONMENTAL EFFECTS**
Environmental aspects of geothermal energy, 3:21434
**GEYSERS GEOTHERMAL FIELD/GEOTHERMAL POWER PLANTS**
Geysers geothermal field, 3:21393
Petrological approach to development of geothermal energy, 3:21441
**GEYSERS GEOTHERMAL FIELD/GEOTHERMAL WELLS**
Geysers geothermal field, 3:21393
**GIANT CELLS**
*See TUMOR CELLS*
**GIANT STARS/STELLAR ATMOSPHERES**
Spatial heterodyne interferometry of VY Canis Majoris, alpha Orionis, alpha Scorpii, and R Leonis at 11 microns, 3:22295 (N-77-27049)
**GINZBURG-LANDAU THEORY/PAIRING INTERACTIONS**
Ginzburg-Landau equations and quantum coherent phenomena in systems with electron-hole pairing, 3:22397
**GLIOBLASTOMAS**
*See NEOPLASMS*
**GLOW DISCHARGES/STABILITY**
Laser discharges in attaching gases, June 25, 1976-June 24, 1977. Final report, 3:22018 (COO-4030-4)
**GLUCOSE/MEMBRANE TRANSPORT**
Placental transport of radionuclides. Terminal report, May 1, 1973-July 31, 1975 (Tritiated water, tritium, $^{14}C$, $^{45}C$, and $^{47}C$ tracers), 3:22268 (COO-2363-4)
**GLYCOLS/SORPTIVE PROPERTIES**
Glycol dehydration of natural gas containing $H_2S$ and $CO_2$, 3:21072 (CONF-7603113-)
Glycol dehydrator design manual, 3:21077 (CONF-7603113-)
**GOLD/CRYSTAL STRUCTURE**
Vacancy properties in gold, 3:21877 (CONF-761027-25)
**GOLD/PHOTOEMISSION**
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL-6906)
**GORKOV-ELIASHBERG THEORY/ELECTRON-PHONON COUPLING**
Role of electronic excitations with energy distribution in local nonequilibrium in increasing T/sub c/, 3:22394
**GORKOV-ELIASHBERG THEORY/TRANSITION TEMPERATURE**
Role of electronic excitations with energy distribution in local nonequilibrium in increasing T/sub c/, 3:22394
**GRAPHITE**
*See also PYROLYTIC CARBON*
**GRAPHITE/THERMAL STRESSES**
Thermal responses of tokamak reactor first walls during cyclic plasma burns, 3:22577 (CONF-771029-189)
**GREAT BRITAIN**
*See UNITED KINGDOM*
**GROUND WATER/FLUID FLOW**
Hanford groundwater transport estimates for hypothetical radioactive waste incidents, 3:22223 (ARH-LD-162)
**GROUND WATER/SALINITY**
Geohydrolic studies of Gulf Coast interior salt domes, 3:22283 (Y/OWI/SUB-77/16537)
**GROUND WATER/TRACER TECHNIQUES**
Comparison of the bromide ion and iodide ion neutron activable tracers with tritiated water as groundwater tracers, 3:22218
**GROUND-WATER RESERVES**
*See AQUIFERS*
**GULF GENERAL ATOMIC FAST BREEDER REACTOR**
*See GCFR REACTOR*
**GULF OF ALASKA/MINERAL CYCLING**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**GULF OF CALIFORNIA/TIDAL POWER**
Analysis of a proposed tidal power plant in the Gulf of Mexico, 3:21458 (UCID-17677)
**GULF OF MEXICO/GEOPRESSURED SYSTEMS**
100,000 quads of natural gas, 3:21061 (HI-2451/3-P)
**GULF OF MEXICO/NATURAL GAS DEPOSITS**
100,000 quads of natural gas, 3:21061 (HI-2451/3-P)

## H

**HADRON-HADRON INTERACTIONS/RESEARCH PROGRAMS**
High energy hadron-hadron collisions. Annual progress report (Summaries of research activities at the University of Georgia), 3:22348 (SRO-946-1)
**HADRONS**
*See also BARYONS*
*MESONS*
*RESONANCE PARTICLES*
**HADRONS/PARTICLE PRODUCTION**
Possible connections between hard and soft processes, 3:22347 (SLAC-PUB-2051)
**HAFNIUM/USES**
Applying hafnium or hafnium alloys as material in plants for reprocessing irradiated nuclear fuels (Patent), 3:21161
**HAFNIUM ALLOYS/USES**
Applying hafnium or hafnium alloys as material in plants for reprocessing irradiated nuclear fuels (Patent), 3:21161
**HALL GENERATORS**
*See MHD GENERATORS*
**HALOGENS/GAS CHROMATOGRAPHY**
Spectroscopic element detector for gas chromatography, 3:21929
**HALOGENS/SPECTROSCOPY**
Spectroscopic element detector for gas chromatography, 3:21929
**HANFORD ATOMIC PRODUCTS OPERATION**
*See HAPO*
**HANFORD RESERVATION/FOOD CHAINS**
Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971-1975, 3:22207 (PNL-2383)
**HANFORD RESERVATION/METEOROLOGY**
Hanford 67-series: a volume of atmospheric field diffusion measurements, 3:22141 (PNL-2433)
**HANFORD RESERVATION/RADIATION MONITORING**
Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971-1975, 3:22207 (PNL-2383)
**HANKEL FUNCTIONS**
*See BESSEL FUNCTIONS*
**HAPO**
*(Hanford Atomic Products Operation.)*
**HAPO/RADIOACTIVE WASTES**
Hanford groundwater transport estimates for hypothetical radioactive waste incidents, 3:22223 (ARH-LD-162)
**HASTELLOY N/PHYSICAL RADIATION EFFECTS**
Status of materials development for molten salt reactors, 3:21587 (ORNL/TM-5920)
**HEAD/BLOOD FLOW**
Blood flow imaging with nuclear magnetic resonance, 3:22242
**HEALTH PHYSICS**
*See RADIATION PROTECTION*
**HEART/SCINTISCANNING**
Alternative displays in nuclear medicine, 3:22243
**HEAT DISTRIBUTION SYSTEMS/DISTRICT HEATING**
Long-distance heating systems (Book, in German), 3:21706
**HEAT EXCHANGERS**
*See also HEAT PUMPS*
**HEAT EXCHANGERS/DESIGN**
Use of fluidized bed heat exchangers in heat pump systems for improved performance. Technical status report, September 1, 1977-November 31, 1977, 3:21772 (COO/4490-1)

**HEAT EXCHANGERS/MATHEMATICAL MODELS**
Numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature (For MHD generators), 3:21760 (N-77-26439)
**HEAT EXCHANGERS/THERMAL EFFICIENCY**
Selection of location for removal of heat of absorption in a tower, 3:20995
**HEAT OF ABSORPTION**
*See ABSORPTION HEAT*
**HEAT PIPE WICKS/THERMAL CONDUCTIVITY**
Effect of the diameter and length of fibers on carcass heat conductivity of metal fiber wicks of heat pipes, 3:22005
**HEAT PIPES/DESIGN**
Evacuated tubular collector utilizing a heat pipe. Progress report, May 1 1975-August 31, 1975, 3:21367 (COO/2608-1)
**HEAT PIPES/MATERIALS**
Material selection considerations for fluoride thermal energy storage containment in a sodium heat pipe environment. Final report 1 June-August 1976, 3:21671 (AD-A-042389)
**HEAT PIPES/MATHEMATICAL MODELS**
Designing evaporative thermal siphons for use in thermoelectric devices, 3:22070
**HEAT PUMPS/HEAT EXCHANGERS**
Use of fluidized bed heat exchangers in heat pump systems for improved performance. Technical status report, September 1, 1977-November 31, 1977, 3:21772 (COO/4490-1)
**HEAT PUMPS/PERFORMANCE**
Experiences with heat pumps in heat recovery from the ground, 3:21771 (AED-Conf-1977-072-010)
**HEAT PUMPS/RESEARCH PROGRAMS**
Use of fluidized bed heat exchangers in heat pump systems for improved performance. Technical status report, September 1, 1977-November 31, 1977, 3:21772 (COO/4490-1)
**HEAT PUMPS/USES**
Evolution of energy resources and their utilization: role of heat, 3:21711
**HEAT PUMPS/WORKING FLUIDS**
Significance of the non-azeotropic binary refrigerants, when used in heat pumps and refrigeration plants, 3:21781
**HEAT RECOVERY EQUIPMENT**
Waste energy source utilization circuit and method (Patent), 3:21517
**HEAT RECOVERY EQUIPMENT/PERFORMANCE**
Heat recovery equipment for engines, 3:21847 (ANL/CES/TE-77-4)
**HEATING OILS/CHEMICAL ANALYSIS**
Analytical methods for polynuclear aromatic hydrocarbons in crude oils, heating oils, and marine tissues, 3:21052
**HEATING OILS/COMBUSTION**
Effect of concentrations of water/fuel oil emulsions on the total emission of solid particles from oil fired boilers, 3:21058
**HEAVY ION ACCELERATORS/BEAM DYNAMICS**
Synchrotron acceleration of variable charge heavy ions, 3:22105 (UCRL-Trans-1541)
**HEAVY ION ACCELERATORS/REVIEWS**
Heavy-ion accelerators, 3:22099
**HEAVY ION REACTIONS**
*See also ARGON 40 REACTIONS*
*NITROGEN 14 REACTIONS*
*OXYGEN 16 REACTIONS*
**HEAVY ION REACTIONS/DAMPING**
Damped heavy-ion collisions, 3:22382
**HEAVY ION REACTIONS/PARTON MODEL**
Relativistic interactions between nuclei, coherence effects and nonscaling, 3:22381 (SLAC-PUB-2010)
**HEBER GEOTHERMAL FIELD/GEOTHERMAL POWER PLANTS**
Economic analyses of geothermal energy development in California. Volume II. Cost/benefit analysis of government program alternatives regarding hot water geothermal power, 3:21427 (SAN-115P108-1(Vol.2))
Heber Geothermal Demonstration Plant, 3:21437
**HELIOSTATS/CONTROL SYSTEMS**
Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108-8/2)
**HELIOSTATS/DESIGN**
Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108-8/2)
Concentrating heliostat array for industrial applications, 3:21383
**HELIOSTATS/PERFORMANCE TESTING**
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108-8/3)
**HELIOSTATS/PRODUCTION**
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108-8/3)
**HELIOSTATS/SPECIFICATIONS**
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108-8/3)
**HELIUM/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**HELIUM/UNDERGROUND STORAGE**
Bush Dome model computing movement of injected crude helium. General instruction manual for computer program KWDX-577-mp for computing gas movement in a gas storage reservoir. Final report, 3:21691 (PB-269451)
**HELIUM 3/ION MOBILITY**
Positive ion mobility in normal $^3$He, 3:22325
**HELIUM 3/QUANTITY RATIO**
Measurements of the osmotic pressure in liquid mixtures of $^3$He and $^4$He near the lambda line and tricritical point, 3:22324 (TID-27646)
**HELIUM 4/QUANTITY RATIO**
Measurements of the osmotic pressure in liquid mixtures of $^3$He and $^4$He near the lambda line and tricritical point, 3:22324 (TID-27646)
**HELIUM HYDRIDES/COLLISIONS**
Effects seen in the interactions of fast molecular-ion beams with matter (Angular distributions, dissociation, polorization, energy losses, transmitted fractions), 3:22311 (CONF-770931-4)
**HELIUM HYDRIDES/TRANSMISSION**
Effects seen in the interactions of fast molecular-ion beams with matter (Angular distributions, dissociation, polorization, energy losses, transmitted fractions), 3:22311 (CONF-770931-4)
**HELIUM-NEON LASERS/FREQUENCY CONTROL**
Investigation of Zeeman beats in a two-mode traveling-wave laser, 3:22043
**HELIUM-NEON LASERS/HIGH-FREQUENCY DISCHARGES**
Microwave-pumped helium-neon laser, 3:22045
**HELIUM-NEON LASERS/POWER**
Microwave-pumped helium-neon laser, 3:22045
**HELIUM-NEON LASERS/TRAVELLING WAVES**
Investigation of Zeeman beats in a two-mode traveling-wave laser, 3:22043
**HETEROCYCLIC COMPOUNDS**
*See also PYRIDINES*
*TRIOXANES*
**HETEROCYCLIC COMPOUNDS/CHEMICAL PREPARATION**
Mannich Bases containing tertiary amines and fuel compositions containing said Mannich Bases (Patent), 3:21982
**HEXENES/VISCOSITY**
Viscosity of liquid hexene-1 at high pressures, 3:21045
**HIGH BTU GAS/CHEMICAL FEEDSTOCKS**
Developing a SNG feedstock allocation scheme that reflects a sound national policy on SNG. Attachment A. Worksheets for efficiency, costs, and emissions analysis. Attachment B. Major sources of data, 3:21738 (TID-28025)
**HIGH BTU GAS/GOVERNMENT POLICIES**
Developing a SNG feedstock allocation scheme that reflects a sound national policy on SNG. Attachment A. Worksheets for efficiency, costs, and emissions analysis. Attachment B. Major sources of data, 3:21738 (TID-28025)
**HIGH ENERGY PHYSICS/RESEARCH PROGRAMS**
High energy physics studies progress report. Part I. Experimental program (Summaries of research activities at Ohio State University), 3:22326 (COO-1545-222)
**HIGH EXPLOSIVES**
*See CHEMICAL EXPLOSIVES*
**HIGH-BETA PLASMA/DRIFT INSTABILITY**
Nonlinear stabilization of the lower-hybrid-drift instability by electron resonance broadening, 3:22487
**HIGH-BETA PLASMA/HYBRID RESONANCE**
Nonlinear stabilization of the lower-hybrid-drift instability by electron resonance broadening, 3:22487
**HIGH-FREQUENCY HEATING**
*See also ECR HEATING*
**HIGH-FREQUENCY HEATING/HYBRID RESONANCE**
Wave absorption in plasma at the ion-hybrid resonance, 3:22418
**HIGH-TEMPERATURE GAS-COOLED REACTOR**
*See HTGR TYPE REACTORS*
**HOMOGENEOUS PLASMA/INSTABILITY GROWTH RATES**
Second-order theory for kparallel$B_0$ electromagnetic instabilities, 3:22481
**HOMOGENEOUS PLASMA/LOSS CONE INSTABILITY**
Electromagnetic instabilities in an anisotropic loss-cone plasma, 3:22499
**HOMOGENEOUS PLASMA/QUANTUM FIELD THEORY**
Quantum field theoretical approach to plasmas, 3:22465
**HOMOGENEOUS PLASMA/TURBULENCE**
Adiabatic modifications to plasma turbulence theories, 3:22510

**HOSE INSTABILITY/INSTABILITY GROWTH RATES**
Second-order theory for kparallel$B_0$ electromagnetic instabilities, 3:22481
**HOSPITALS/AIR CONDITIONING**
Air-conditioning systems in hospitals, 3:21796
**HOSPITALS/ENERGY MANAGEMENT**
Energy management in modern hospitals, 3:21795
**HOSPITALS/RADIOACTIVE WASTES**
Environmental radioactivity from hospitals, 3:22226
**HOSPITALS/SOLAR COOLING SYSTEMS**
Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
**HOSPITALS/SOLAR HEATING SYSTEMS**
Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
**HOSPITALS/SOLAR WATER HEATERS**
Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
**HOT SPRINGS/GAMMA SPECTROSCOPY**
Nuclear techniques in geochemical studies of hydrothermal systems, 3:21412
**HOT-DRY-ROCK SYSTEMS/ENVIRONMENTAL EFFECTS**
Environmental investigations associated with the LASL hot dry rock geothermal energy development project, 3:21432 (LA-6972)
**HOT-DRY-ROCK SYSTEMS/GEOPHYSICAL SURVEYS**
Hot dry rock: widespread but invisible (Report of workshop discussion), 3:21403
**HOT-DRY-ROCK SYSTEMS/HYDRAULIC FRACTURING**
Proceedings of the second NATO-CCMS information meeting on dry hot rock geothermal energy, 3:21448 (LA-7021-C)
**HOT-DRY-ROCK SYSTEMS/MEETINGS**
Proceedings of the second NATO-CCMS information meeting on dry hot rock geothermal energy, 3:21448 (LA-7021-C)
**HOT-DRY-ROCK SYSTEMS/RESEARCH PROGRAMS**
Proceedings of the second NATO-CCMS information meeting on dry hot rock geothermal energy, 3:21448 (LA-7021-C)
**HOUSES/DESIGN**
Design of a solar heated energy conservation house for western Canada, 3:21352
**HOUSES/ENERGY CONSERVATION**
Feedback as a means of decreasing residential energy consumption. Report PU/CES 34, 3:21784 (COO/2789-1)
Home energy savers program: a little time can save a lot of money, 3:21709 (TID-28047)
Retrofitting an existing wood frame residence for energy conservation: an experimental study. Final report, 3:21785 (PB-269847)
**HOUSES/POWER DEMAND**
Feedback as a means of decreasing residential energy consumption. Report PU/CES 34, 3:21784 (COO/2789-1)
**HOUSES/RETROFITTING**
Retrofitting an existing wood frame residence for energy conservation: an experimental study. Final report, 3:21785 (PB-269847)
**HOUSES/SOLAR COOLING SYSTEMS**
Analysis of a solar powered residential cooling and heating system, 3:21355
Florida residential demonstration, 3:21337
Integrated 100% solar heated and cooled house using multi-stage air collectors, 3:21359
**HOUSES/SOLAR HEATING SYSTEMS**
Analysis of a solar powered residential cooling and heating system, 3:21355
Design, installation and testing of the HUD solar home in Dacula, Georgia, 3:21347
Design and installation of the HUD solar home in Shenandoah, Georgia, 3:21346
Design and installation of hydronic solar systems for three cycle-two HUD housing units in Georgia, 3:21348
Design of a solar heated energy conservation house for western Canada, 3:21352
First year's operation: residential solar retrofit, 3:21339
Florida residential demonstration, 3:21337
Improving the performance of a solar energy heating system, 3:21356
Installation of a commercially-available pre-packaged hydronic solar heating system by a homeowner, 3:21349
Installation and operation of solar heating system for the Hooker Barnes solar home, 3:21350
Integrated 100% solar heated and cooled house using multi-stage air collectors, 3:21359
Possibilities of solar space heating (In German Federal Republic), 3:21328 (AED-Conf-1977-053-004)
Preliminary performance data on a solar heated house (Model 24-31-B SH), 3:21341
Typical Mathew Solar House: a three-year report, 3:21336
Unique solar residence uses conventional construction techniques, 3:21340
**HOUSES/SOLAR WATER HEATERS**
Analysis of a solar powered residential cooling and heating system, 3:21355
Design and installation of hydronic solar systems for three cycle-two HUD housing units in Georgia, 3:21348
Florida residential demonstration, 3:21337
Installation and operation of solar heating system for the Hooker Barnes solar home, 3:21350
**HOUSES/THERMAL INSULATION**
Comparison concerning thermal insulation installed at a later stage, 3:21791
**HOUSES/WINDOWS**
Lowering heat consumption by means of infrared mirror coating of windows, facades and roofs, 3:21786
**HTGR TYPE REACTORS**
*See also THTR-300 REACTOR*
*VRAIN REACTOR*
**HTGR TYPE REACTORS/COATED FUEL PARTICLES**
Behavior of fission product gases in HTGR fuel material, 3:21572 (GA-A-13723)
Evaluation of BISO and TRISO coated $ThO_2$ fuel particles irradiated in HFIR capsules HT-12 through HT-15 and HT-17 through HT-19, 3:21571 (GA-A-13557)
Fundamentals on the agglomerate model and its relation to the physical properties of pyrocarbon, 3:21574
Reactions between SiC and Pd or $CeO_2$ at high temperatures, 3:21576
**HTGR TYPE REACTORS/FUEL CYCLE**
Criticality considerations for $^{233}U$ fuels in an HTGR fuel refabrication facility, 3:21144 (ORNL/TM-6136)
Low-enrichment and mid-enrichment denatured (thorium) fuels for the HTGR: a feasibility study. Final report, 3:21573 (GA-A-14684)
Preliminary maintainability analysis of the HTGR dry head-end reprocessing systems, 3:21151 (GA-A-14678)
**HTGR TYPE REACTORS/REACTOR PROTECTION SYSTEMS**
Safety analysis of an HTGR plant including emergency shutdown. Appendix, Volume 2. Final report, 3:21659 (K-76-124U(R)(Vol.2))
**HTGR TYPE REACTORS/REACTOR SAFETY**
Safety analysis of an HTGR plant including emergency shutdown. Appendix, Volume 2. Final report, 3:21659 (K-76-124U(R)(Vol.2))
**HUDSON RIVER/TEMPERATURE DISTRIBUTION**
Thermal impact assessment of multi-power plant operations on estuaries, 3:22229
**HUDSON RIVER/WATER POLLUTION**
Simulation of chlorinated water discharges from power plants on estuaries and rivers, 3:22216
**HUMAN CELLS**
*See ANIMAL CELLS*
**HUMAN POPULATIONS/HEALTH HAZARDS**
$^{222}Rn$ and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
Atmospheric characteristics essential for health effects modeling, 3:22181 (HASL-325)
Measurements of $^{222}Rn$ in water and indoor airborne $^{222}Rn$ originating in water, 3:22221 (HASL-325)
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**HUMAN POPULATIONS/INTERNAL IRRADIATION**
Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971-1975, 3:22207 (PNL-2383)
**HUMAN POPULATIONS/LOW DOSE IRRADIATION**
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**HUMAN POPULATIONS/MORTALITY**
Estimate of early mortality and morbidity following acute inhalation of plutonium, 3:22255
**HUMAN POPULATIONS/RADIATION DOSES**
Cesium-137 in various Chicago foods (collection month: October 1977), 3:22204 (EML-334)
Drinking water and health. Part II, Chapters 6 and 7. A report of the safe drinking water committee. Final report, 3:22225 (PB-270423)
Estimation of $^{222}Rn$ daughter doses from large-area sources, 3:22195
Jeremiah Environmental Computational System, 3:22194
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
Radionuclide concentrations in selected foodstuffs and wildlife from the Hanford environs, 1971-1975, 3:22207 (PNL-2383)
Radiostrontium in milk and tap water (New York City), 3:22206 (EML-334(App.))
**HUMAN POPULATIONS/RADIATION HAZARDS**
Penchant for protectionism, 3:21217

**HUMAN POPULATIONS/RADIATION PROTECTION**
General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants (Sweden), 3:22260 (ORNL-tr-4547)
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
**HUMIDITY/BIOLOGICAL EFFECTS**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**HVAC SYSTEMS/POWER TRANSMISSION LINES**
ac transmission line field measurements, 3:21550 (HCP/T6010-E1)
**HYBRID ELECTRIC-POWERED VEHICLES/FLYWHEELS**
Utilization of flywheels for the evolution of high-performance electric vehicles, 3:21857 (UCRL-52346)
**HYBRID REACTORS/BREEDING RATIO**
Physics of tritium breeding as a geometric programming problem, 3:22630 (WFPS-TME-068)
**HYBRID REACTORS/COMPARATIVE EVALUATIONS**
Laser driven fusion fission hybrids, 3:22539 (UCRL-79653)
**HYBRID REACTORS/DESIGN**
Mirror hybrid (fusion-fission) reactor, 3:22542 (UCRL-80076)
**HYBRID REACTORS/ECONOMIC DEVELOPMENT**
Economic model of a relativistic electron beam hybrid reactor, 3:22662
**HYBRID REACTORS/FEASIBILITY STUDIES**
Feasibility of beam driven semi-catalyzed deuterium fusion neutron sources for hybrid reactor applications, 3:22683 (PPPL-1399)
**HYBRID REACTORS/MECHANICAL STRUCTURES**
Mechanical structure of the mirror hybrid reactor power plant, 3:22575
**HYBRID REACTORS/SPECIFICATIONS**
Mechanical structure of the mirror hybrid reactor power plant, 3:22575
TDHR-a Tokamak demonstraction hybrid reactor, 3:22560
**HYBRID REACTORS/THERMONUCLEAR FUELS**
Catalyzed deuterium fusion-fission hybrid reactors, 3:22570
Cost of tritium bred in a critical fission reactor, 3:22628
**HYBRID REACTORS/THORIUM CYCLE**
Laser driven fusion fission hybrids, 3:22539 (UCRL-79653)
**HYBRID RESONANCE/KINK INSTABILITY**
Nonlinear development of lower hybrid cones, 3:22486
**HYDRAULIC FRACTURING/BOREHOLES**
Selection of objects for exerting an effect on bottom hole zone, given a great number of dependent characteristics, 3:20967
**HYDRAULIC TRANSPORT/FEASIBILITY STUDIES**
Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps, 3:22015 (STU-75-5234)
**HYDRAULIC TRANSPORT/PERFORMANCE TESTING**
Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps, 3:22015 (STU-75-5234)
**HYDRAULIC TURBINES**
*See also TURBOGENERATORS*
**HYDRAULIC TURBINES/MODIFICATIONS**
Power production at Federal dams could be increased by modernizing turbines and generators, 3:21266 (PB-269254)
**HYDRIODIC ACID/DIPOLE MOMENTS**
Chemical applications of molecular quantum theory, 3:21947 (LBL-6699)
**HYDROCARBONS**
*See also ALKANES*
*BENZENE*
*NAPHTHALENE*
*TETRALIN*
*TOLUENE*
*XYLENES*
**HYDROCARBONS/BIODEGRADATION**
Microbial petroleum degradation: the role of cladosporium resinae, 3:22274 (CONF-730386-)
**HYDROCARBONS/BIOLOGICAL EFFECTS**
Effect of a bunker fuel on the beach bacterial flora, 3:22273 (CONF-730386-)
Respiratory response of juvenile chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil, 3:22275 (CONF-730386-)
**HYDROCARBONS/COOLING**
Multistage cooling of crude hydrocarbon gases (Patent), 3:20987
**HYDROCARBONS/EXTRACTION**
Evaluation of some methods of analysis for petroleum hydrocarbons in marine organisms, 3:21053
**HYDROCARBONS/FRACTIONATION**
Investigation of the operation of a gas separation unit of a catalytic reforming installation, 3:20992
**HYDROCARBONS/GAS CHROMATOGRAPHY**
Evaluation of some methods of analysis for petroleum hydrocarbons in marine organisms, 3:21053
**HYDROCARBONS/ISOMERIZATION**
Calculation of $^{13}C$ relaxation times and nuclear Overhauser enhancements in a hydrocarbon chain undergoing gauche-trans isomerism, 3:21979
**HYDROCARBONS/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
**HYDROCARBONS/PYROLYSIS**
Simulation of product distributions from pyrolysis of normal and branched alkane mixtures over a wide range of conversions, 3:20989
**HYDROCARBONS/REFORMER PROCESSES**
Hydrogen-producing hydrocarbon conversion with gravity-flowing catalyst particles (Patent), 3:20984
**HYDROCARBONS/SENSIBLE HEAT STORAGE**
Analysis of thermally degraded sensible heat storage hydrocarbons, 3:21384 (SAND-77-8264)
**HYDROCARBONS/SPIN-LATTICE RELAXATION**
Calculation of $^{13}C$ relaxation times and nuclear Overhauser enhancements in a hydrocarbon chain undergoing gauche-trans isomerism, 3:21979
**HYDROCARBONS/SPIN-SPIN RELAXATION**
Calculation of $^{13}C$ relaxation times and nuclear Overhauser enhancements in a hydrocarbon chain undergoing gauche-trans isomerism, 3:21979
**HYDROCARBONS/SYNTHESIS**
Proteins as a possible source material of low molecular weight petroleum hydrocarbons, 3:21261
Transition metal-graphite catalysts for production of light hydrocarbons from synthesis gas. Annual report, August 1, 1976-July 31, 1977, 3:20858 (FE-2467-4)
**HYDROCARBONS/THERMAL DEGRADATION**
Analysis of thermally degraded sensible heat storage hydrocarbons, 3:21384 (SAND-77-8264)
**HYDROCHLORIC ACID/CHEMICAL REACTION KINETICS**
Reaction and deactivation of HCl (v=1, 2) by O atoms, 3:21949
**HYDROCHLORIC ACID/FLUORESCENCE**
Reaction and deactivation of HCl (v=1, 2) by O atoms, 3:21949
**HYDRODYNAMICS**
*See also MAGNETOHYDRODYNAMICS*
**HYDRODYNAMICS/COMPUTER CODES**
LEG System: a general Lagrangian-to-Eulerian hydrodynamic code linkage, 3:22323 (UCID-17680)
**HYDROELECTRIC POWER PLANTS**
Development of a total energy system for the Cedar Gap Christian Retreat Center (Combination of hydroelectric units on streams, wind generators, and solar thermal power plant with wood-burning boiler backup), 3:21707
**HYDROELECTRIC POWER PLANTS/CAPACITY**
Determination of energy generation for a series of power stations connected in cascade, using a regression analysis, 3:21264
**HYDROELECTRIC POWER PLANTS/HYDRAULIC TURBINES**
Power production at Federal dams could be increased by modernizing turbines and generators, 3:21266 (PB-269254)
**HYDROELECTRIC POWER PLANTS/LICENSING**
Planning status report: water resource appraisals for hydroelectric licensing, 3:21263 (TID-28068)
**HYDROELECTRIC POWER PLANTS/PLANNING**
Planning status report: water resource appraisals for hydroelectric licensing, 3:21263 (TID-28068)
**HYDROELECTRIC POWER PLANTS/TURBOGENERATORS**
Power production at Federal dams could be increased by modernizing turbines and generators, 3:21266 (PB-269254)
**HYDROGEN/DISSOCIATION**
Direct calculation of the equilibrium value of the energy of activation for dissociation of $H_3$ by Ar and evidence for the important contribution of collisional dissociation from low vibrational quantum numbers and high rotational quantum numbers at shock tube temperatures, 3:21954
**HYDROGEN/ELECTROPHORESIS**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**HYDROGEN/ION-ATOM COLLISIONS**
Some features of the potential energy surfaces for the $F^+ + H_2$ ion-molecule reaction, 3:22321
**HYDROGEN/MOLECULE-MOLECULE COLLISIONS**
Direct calculation of the equilibrium value of the energy of activation for dissociation of $H_3$ by Ar and evidence for the important contribution of collisional dissociation from low vibrational quantum numbers and high rotational quantum numbers at shock tube temperatures, 3:21954
**HYDROGEN 2**
*See DEUTERIUM*
**HYDROGEN 3**
*See TRITIUM*
**HYDROGEN CHLORIDES**
*See HYDROCHLORIC ACID*

**HYDROGEN IONS 1 MINUS/ACCELERATION**
Acceleration of one ampere negative ion beams to energies up to 120 keV, 3:22614 (BNL-23391)
**HYDROGEN IONS 1 MINUS/ION SOURCES**
Magnetron discharge as a source of H-ions, 3:22115
**HYDROGEN IONS 3 PLUS/ELECTRONIC STRUCTURE**
Effects seen in the interactions of fast molecular-ion beams with matter (Angular distributions, dissociation, polorization, energy losses, transmitted fractions), 3:22311 (CONF-770931-4)
**HYDROGEN PRODUCTION**
*See also STEAM-IRON PROCESS*
Hydrogen-producing hydrocarbon conversion with gravity-flowing catalyst particles (Patent), 3:20984
Production of a hydrogen-rich gas from a CO-containing fuel gas (Patent; process comprises a formate synthesis step and a catalytic formate decomposition step), 3:21244
**HYDROGEN PRODUCTION/BIOSYNTHESIS**
Continuous hydrogen production by immobilized whole cells of Clostridium butyricum, 3:21251
**HYDROGEN PRODUCTION/ELECTROLYSIS**
Fusion energy applied to synthetic fuel production: a report to the DOE Division of Magnetic Fusion Energy based on a preliminary study by an ad-hoc advisory group, 3:21243 (CONF-770593-)
Nuclear reactors and hydrogen production, 3:21246
Water splitting for the production of non-polluting energy carriers, 3:21247
**HYDROGEN PRODUCTION/PHOTOELECTROLYSIS**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
Photo-electrolytic production of hydrogen (Patent), 3:21245
Photoelectrolysis of water by solar radiation (Patent), 3:21315
Solar energy conversion (Patent), 3:21314
**HYDROGEN PRODUCTION/PHOTOLYSIS**
Evaluation of the photochemical production of hydrogen from solar energy, 3:21313 (UCID-17535)
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
**HYDROGEN PRODUCTION/PHOTOSYNTHESIS**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
**HYDROGEN PRODUCTION/RADIOLYSIS**
Fusion energy applied to synthetic fuel production: a report to the DOE Division of Magnetic Fusion Energy based on a preliminary study by an ad-hoc advisory group, 3:21243 (CONF-770593-)
**HYDROGEN PRODUCTION/RESEARCH PROGRAMS**
Development of the steam-iron system for production of hydrogen for the HYGAS process. Project 8920 final status report, May 1, 1973-June 30, 1976, 3:21252 (FE-1518-46)
**HYDROGEN PRODUCTION/STEAM-IRON PROCESS**
Development of the steam-iron process for hydrogen production. Project 9010 monthly status report, September 1-30, 1977, 3:21253 (FE-2435-19)
Development of the steam-iron system for production of hydrogen for the HYGAS process. Project 8920 final status report, May 1, 1973-June 30, 1976, 3:21252 (FE-1518-46)
**HYDROGEN PRODUCTION/THERMOCHEMICAL PROCESSES**
Fusion energy applied to synthetic fuel production: a report to the DOE Division of Magnetic Fusion Energy based on a preliminary study by an ad-hoc advisory group, 3:21243 (CONF-770593-)
Proposal to utilize fusion reactor energy sources for chemical process applications, 3:21248 (UCID-17590)
Study of thermochemical hydrogen preparation. II. Electrochemical hybrid cycle using sulfur-iodine system, 3:21249
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
Thermochemical water-splitting cycle applicable to fusion reactors for production of synthetic fuels, 3:22685
Water splitting for the production of non-polluting energy carriers, 3:21247
**HYDROGEN STORAGE**
*See also CHEMISORPTION*
*CRYOGENICS*
*TANKS*
**HYDROGEN STORAGE/IRON HYDRIDES**
Metal hydride storage for mobile and stationary applications, 3:21255
**HYDROGEN STORAGE/LANTHANUM HYDRIDES**
Low-temperature absorption equilibrium and chemisorption in the $LaNi_5$(activated)/$H_2$ system, 3:21254
**HYDROGEN STORAGE/MAGNESIUM HYDRIDES**
Metal hydride storage for mobile and stationary applications, 3:21255
**HYDROGEN STORAGE/NICKEL HYDRIDES**
Low-temperature absorption equilibrium and chemisorption in the $LaNi_5$(activated)/$H_2$ system, 3:21254
**HYDROGEN STORAGE/TITANIUM HYDRIDES**
Metal hydride storage for mobile and stationary applications, 3:21255
**HYDROGEN SULFATES**
*See SULFURIC ACID*
**HYDROGEN SULFIDES/BIOLOGICAL EFFECTS**
Effects of $H_2S$, $H_2S$ + $CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**HYDROGEN SULFIDES/ENVIRONMENTAL EFFECTS**
Glycol dehydration of natural gas containing $H_2S$ and $CO_2$, 3:21072 (CONF-7603113-)
**HYDROGEN SULFIDES/INFRARED SPECTRA**
Pressure-broadened linewidths of hydrogen sulfide, 3:21971
**HYDROGEN SULFIDES/MONITORING**
Gas quality monitoring, 3:21070 (CONF-7603113-)
**HYDROGEN SULFIDES/POLLUTION REGULATIONS**
Relationship of new Texas sour gas rules to gas conditioning operations, 3:21088 (CONF-7603113-)
**HYDROGEN SULFIDES/REMOVAL**
Fundamentals of gas treating, 3:21071 (CONF-7603113-)
Selective hydrogen sulfide removal, 3:21075 (CONF-7603113-)
Sweetening of light hydrocarbon liquids, 3:21073 (CONF-7603113-)
**HYDROGEN SULFIDES/TOXICITY**
Philosophies of safety in sour gas processing, 3:21087 (CONF-7603113-)
**HYDROLOGY/WELL LOGGING**
Geophysical well logging for geohydrological purposes in unconsolidated formations, 3:22282 (N-77-26598)
**HYDROTHERMAL SYSTEMS**
*See also GEOTHERMAL SYSTEMS*
**HYDROTHERMAL SYSTEMS/GEOCHEMISTRY**
Nuclear techniques in geochemical studies of hydrothermal systems, 3:21412
**HYDROTHERMAL SYSTEMS/MEETINGS**
XII International Congress of Hydrothermal Techniques. Abstracts of papers presented ((Abstracts only)), 3:21385 (CONF-761219-(Absts.))
**HYDROTHERMAL SYSTEMS/SEISMIC WAVES**
Mechanism of change with time of seismic wave speed (effect of water and heat), 3:21399
**HYDROXYBENZENE**
*See PHENOL*
**HYDROXYLAMINE/CRYSTAL STRUCTURE**
Tripotassium hydroxylaminetrisulfonate sesquihydrate, neutron data, 3:21968
**HYDROXYTOLUENES**
*See CRESOLS*
**HYGAS PROCESS/COMPUTER-AIDED DESIGN**
Computer-aided industrial process design: the ASPEN project. First quarterly progress report, June 1-August 31, 1976, 3:20859 (MIT-2295T9-1)
**HYGAS PROCESS/HYDROGEN PRODUCTION**
Development of the steam-iron system for production of hydrogen for the HYGAS process. Project 8920 final status report, May 1, 1973-June 30, 1976, 3:21252 (FE-1518-46)
**HYGAS PROCESS/PILOT PLANTS**
Petrographic method for selective determination of a component (raw coal) in a mixture of products from processing of coal, 3:20850 (CONF-780305-1)
**HYGAS PROCESS/RESEARCH PROGRAMS**
Development of the steam-iron system for production of hydrogen for the HYGAS process. Project 8920 final status report, May 1, 1973-June 30, 1976, 3:21252 (FE-1518-46)
**HYGAS PROCESS/SIMULATION**
Computer-aided industrial process design: the ASPEN project. First quarterly progress report, June 1-August 31, 1976, 3:20859 (MIT-2295T9-1)
Computer-aided industrial process design: the ASPEN project. Second quarterly progress report, September 1-November 30, 1976, 3:20860 (MIT-2295T9-2)
**HYPOFLUOROUS ACID/CHEMICAL REACTIONS**
Reaction of fluorine and hypofluorous acid with some substitution-inert complex ions in aqueous perchloric acid solutions, 3:21959

## I

**IAEA SAFEGUARDS**
Research required for international safeguards, 3:21224

**I-BEAM TYPE REACTORS/ACCELERATORS**
Acceleration systems for heavy-ion beams for inertial confinement fusion, 3:22639 (LBL-6768)
**I-BEAM TYPE REACTORS/FIRST WALL**
First wall costs of an ion-beam fusion reactor, 3:22642 (UCID-17555)
**ICE/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**ICELAND/GEOTHERMAL POWER PLANTS**
New industrial development of geothermal resources, 3:21440
**ICES/DIESEL ENGINES**
Internal combustion piston engines, 3:21846 (ANL/CES/TE-77-1)
**ICES/DUAL-FUEL ENGINES**
Internal combustion piston engines, 3:21846 (ANL/CES/TE-77-1)
**ICES/EVALUATION**
State of the art for integrated Energy/Utility Systems, 3:21849 (PB-269684)
**ICES/HEAT RECOVERY EQUIPMENT**
Heat recovery equipment for engines, 3:21847 (ANL/CES/TE-77-4)
**ICES/SPARK IGNITION ENGINES**
Internal combustion piston engines, 3:21846 (ANL/CES/TE-77-1)
**IGNEOUS ROCKS**
*See also MAGMA*
**IGNEOUS ROCKS/FISSION TRACKS**
Radioactive halos as possible indicators for geochemical processes in magmatites, 3:21135
**IGT WASTE PROCESS**
*See BIOGAS PROCESS*
**ILLINOIS/AIR POLLUTION**
Hydrocarbon and oxidant chemistry observed at a site near St. Louis. Final report 30 June 1975-30 June 1976, 3:22145 (PB-269559)
**ILLINOIS/WIND**
Variance analysis of wind characteristics for energy conversion, 3:21461
**IMAGE CONVERTERS/DESIGN**
High-speed image converters for studying laser radiation with picosecond and femtosecond time resolution, 3:22431 (UCRL-Trans-11298)
**IMCO**
*(International Maritime Consultative Organization.)*
**IMCO/TANKER SHIPS**
1973 IMCO convention: a tanker operator's viewpoint, 3:21022
**IMPERIAL VALLEY**
*See also EAST MESA GEOTHERMAL FIELD*
**IMPERIAL VALLEY/ECONOMY**
Economic impact of geothermal energy development, 3:21429
Multisector analysis of the impact of geothermal development on the economy of Imperial County, California, 3:21430
**IMPERIAL VALLEY/ENERGY SOURCE DEVELOPMENT**
Economic impact of geothermal energy development, 3:21429
Geographical environmental analysis. Final report, 3:21419
Regulatory, planning and policy aspects of geothermal energy development in Imperial County, California, 3:21415
**IMPERIAL VALLEY/POPULATION DYNAMICS**
Population analysis relative to geothermal energy development, Imperial County, California, 3:21416
**IMPERMEABLE DRY ROCK**
*See HOT-DRY-ROCK SYSTEMS*
**IN UTERO IRRADIATION**
*See PRENATAL IRRADIATION*
**INCINERATORS/PERFORMANCE TESTING**
Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April-June 1977, 3:21172 (MLM-2463)
**INCLUSION COMPLEXES**
*See CLATHRATES*
**INCLUSIVE DISTRIBUTION**
*See INCLUSIVE INTERACTIONS*
**INCLUSIVE INTERACTIONS**
*(The group of all interactions of two particles producing a specific final state.)*
**INCLUSIVE INTERACTIONS/TRANSVERSE MOMENTUM**
Possible connections between hard and soft processes, 3:22347 (SLAC-PUB-2051)
**INDIA/HYDROGEN-BASED ECONOMY**
Hydrogen Energy Task Force report of the workshop on hydrogen energy, July 13-14, 1977, 3:21242 (NP-22816)
**INDIUM/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**INDIUM ALLOYS/MIXED STATE**
Viscous drag on mobile dislocations in type-II superconductors, 3:21886
**INDIUM COMPOUNDS/FILM CONDENSATION**
Superconductivity of rapidly condensed films, 3:21888
**INDIUM COMPOUNDS/SUPERCONDUCTIVITY**
Superconductivity of rapidly condensed films, 3:21888
**INDIUM OXIDES/ELECTRICAL PROPERTIES**
Effects of heat treatment on the optical and electrical properties of indium-tin oxide films, 3:21903
**INDIUM OXIDES/OPTICAL PROPERTIES**
Effects of heat treatment on the optical and electrical properties of indium-tin oxide films, 3:21903
**INDUSTRIAL PLANTS**
*See also DEMONSTRATION PLANTS*
*FEED MATERIALS PLANTS*
*OIL SHALE PROCESSING PLANTS*
*PETROCHEMICAL PLANTS*
*WASTE PROCESSING PLANTS*
**INDUSTRIAL PLANTS/BOILERS**
Field testing: application of combustion modifications to control pollutant emissions from industrial boilers. Phases I and II (data supplement). Supplemental report for June 1973-September 1975, 3:22092 (PB-270112)
**INDUSTRIAL PLANTS/ENERGY CONSERVATION**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)
Cutting fuel costs, 3:21779
**INDUSTRIAL PLANTS/ENERGY SHORTAGES**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB-269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB-269366)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS, 3:21815 (PB-269367)
**INDUSTRIAL PLANTS/FUEL CONSUMPTION**
Cutting fuel costs, 3:21779
**INDUSTRIAL PLANTS/FUEL SUBSTITUTION**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB-269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB-269366)
**INDUSTRIAL PLANTS/GAS FURNACES**
Calculation of radiative heat transfer in a large gas fired furnace, 3:22089
**INDUSTRIAL PLANTS/GEOTHERMAL PROCESS HEAT**
Use of geothermal heat for sugar refining. Final report, October 1, 1976-May 31, 1977, 3:21450 (SAN/1317-3)
**INDUSTRIAL PLANTS/HEAT RECOVERY EQUIPMENT**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)
**INDUSTRIAL PLANTS/POLLUTION CONTROL EQUIPMENT**
Air pollution cleaning needs varied approach, 3:22095
Costly business of purifying noxious emissions, 3:22093
**INDUSTRIAL PLANTS/SUGAR BEETS**
Use of geothermal heat for sugar refining. Final report, October 1, 1976-May 31, 1977, 3:21450 (SAN/1317-3)
**INDUSTRIAL PLANTS/TOTAL ENERGY SYSTEMS**
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design (1.72 MW thermal and 383.6 kW electric power for 42,000 $ft^2$ knitwear plant), 3:21323 (ALO/3987-1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 $ft^2$ knitwear plant), 3:21324 (ALO/3987-1/3)
**INDUSTRIAL PLANTS/WASTE HEAT UTILIZATION**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)
**INDUSTRIAL RADIOGRAPHY**
*See also NEUTRON RADIOGRAPHY*
*X-RAY RADIOGRAPHY*
**INDUSTRIAL RADIOGRAPHY/RADIOLOGICAL PERSONNEL**
Safety training as a means of reducing overexposures to radiographers, 3:22257
**INDUSTRIAL WASTES**
*See also REFUSE DERIVED FUELS*
**INDUSTRIAL WASTES/COMBUSTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
**INDUSTRIAL WASTES/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
**INDUSTRIAL WASTES/RECYCLING**
Sludge from paper production. Final report. Recycling of industrial wastes. Phase II, 3:21840 (BMFT-FB-T-77-08)

**INDUSTRY**
*See also CHEMICAL INDUSTRY*
*COAL INDUSTRY*
*DEVELOPING COUNTRIES*
*FOOD INDUSTRY*
*METAL INDUSTRY*
*MINERAL INDUSTRY*
*NATURAL GAS INDUSTRY*
*NUCLEAR INDUSTRY*
*OIL SHALE INDUSTRY*
*PAPER INDUSTRY*
*PETROLEUM INDUSTRY*
*TEXTILE INDUSTRY*

**INDUSTRY/ENERGY CONSERVATION**
Energy saving: system to limit and optimize power consumption in process technology, 3:21834

**INDUSTRY/TOTAL ENERGY SYSTEMS**
Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report (24 facilities in 6 industry groups), 3:21325 (SAN/1132-2/4)

**INFORMATION SYSTEMS/PLANNING**
General features of a scientific data base management system, 3:22697 (UCRL-80171)

**INFRARED RADIATION/MEETINGS**
Second international and winter school on submillimeter waves and their applications, 3:22067

**INHOMOGENEOUS PLASMA/ELECTROMAGNETIC RADIATION**
Equation of polarization transfer in an inhomogeneous magnetized plasma. I. Formalism, 3:22525
New approach of studying electromagnetic mode coupling in inhomogeneous magnetized plasma. I. Normal incidence, 3:22524
Variational method for electromagnetic waves in a magneto-plasma, 3:22494

**INHOMOGENEOUS PLASMA/FLUTE INSTABILITY**
Lagrangian description of flute drift turbulence of $\theta$-pinch plasma, 3:22411

**INHOMOGENEOUS PLASMA/LASER RADIATION**
Raman sidescatter instability in a nonuniform plasma, 3:22506 (LBL-6703)

**INHOMOGENEOUS PLASMA/MICROWAVE RADIATION**
Anisotropic fast electron emission from a microwave irradiated plasma slab, 3:22512

**INHOMOGENEOUS PLASMA/PLASMA DRIFT**
Lagrangian description of flute drift turbulence of $\theta$-pinch plasma, 3:22411

**INHOMOGENEOUS PLASMA/PLASMA WAVES**
Convective excitation of quasistatic waves in an inhomogeneous anisothermic plasma. II. Nonlinear estimates, 3:22527
Parametric excitation of Langmuir waves in an inhomogeneous plasma, 3:22516
Pseudo-three-dimensional turbulence in magnetized nonuniform plasma, 3:22508

**INHOMOGENEOUS PLASMA/RAMAN EFFECT**
Raman sidescatter instability in a nonuniform plasma, 3:22506 (LBL-6703)

**INHOMOGENEOUS PLASMA/SPECTRAL DENSITY**
Pseudo-three-dimensional turbulence in magnetized nonuniform plasma, 3:22508

**INHOMOGENEOUS PLASMA/TURBULENCE**
Pseudo-three-dimensional turbulence in magnetized nonuniform plasma, 3:22508

**INHOMOGENEOUS PLASMA/WAVE PROPAGATION**
Resonant particles at a wave front in a weakly inhomogeneous plasma, 3:22526

**INJECTION WELLS**
Question of restoration of injectivity of injection wells and problem of control of the gushing process, 3:20976

**INSECTS/CYTOLOGY**
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967-September 1977, 3:22264 (COO-38-1838)

**INSECTS/GENETICS**
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967-September 1977, 3:22264 (COO-38-1838)

**INSECTS/PEST CONTROL**
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967-September 1977, 3:22264 (COO-38-1838)

**IN-SITU COMBUSTION/REMOTE SENSING**
Remote electromagnetic sensing of underground coal burns. Quarterly technical progress report, March-May 1977, 3:20857 (FE-2414-4)

**IN-SITU GASIFICATION/BOREHOLE LINKING**
Note on underground coal gasification (US Bureau of Mines test at Hanna, Wy), 3:20873

**IN-SITU GASIFICATION/HYDRAULIC FRACTURING**
Note on underground coal gasification (US Bureau of Mines test at Hanna, Wy), 3:20873

**IN-SITU GASIFICATION/MONITORING**
Instrumentation and process control development for in situ coal gasification. Tenth and eleventh quarters' report: March-August 1977, 3:20862 (SAND-77-1821)

**IN-SITU GASIFICATION/REMOTE SENSING**
Remote electromagnetic sensing of underground coal burns. Quarterly technical progress report, March-May 1977, 3:20857 (FE-2414-4)

**IN-SITU GASIFICATION/RESEARCH PROGRAMS**
In-situ coal gasification. Part of the energy research program of the Federal government (German Federal Republic), 3:20867

**INSOLATION/CALCULATION METHODS**
Estimating monthly means of daily totals of direct normal solar radiation and of total solar radiation on a south-facing, 45°, tilted surface, 3:21268 (SAND-77-0874)

**INSOLATION/DAILY VARIATIONS**
Sun as a source of energy in Finland, 3:21269

**INSOLATION/SEASONAL VARIATIONS**
Sun as a source of energy in Finland, 3:21269

**INSOLATION/TABLES**
Hourly solar radiation data for vertical and horizontal surfaces on average days in the United States and Canada (80 locations), 3:21267 (NBS-BSS-96)

**INSULATION (THERMAL)**
*See THERMAL INSULATION*

**INTEGRATED COMMUNITY ENERGY SYSTEMS**
*See ICES*

**INTERCALATES**
*See CLATHRATES*

**INTERNAL COMBUSTION ENGINES**
*See also DIESEL ENGINES*

**INTERNAL COMBUSTION ENGINES/AFTERBURNERS**
After-burning preventive and flame-out apparatus (Patent), 3:21865

**INTERNAL COMBUSTION ENGINES/DESIGN**
Method and device for the conversion of heat into mechanical energy (Patent), 3:21851
Reciprocating internal combustion engine for operation with fuel in powder form (Patent), 3:21861

**INTERNAL COMBUSTION ENGINES/FUEL ECONOMY**
Fuel conservation means for internal combustion engines and the like (Patent), 3:21863

**INTERNAL COMBUSTION ENGINES/FUEL SYSTEMS**
Fuel conservation means for internal combustion engines and the like (Patent), 3:21863
Steam injection apparatus (Patent), 3:21862

**INTERNAL COMBUSTION ENGINES/POLLUTION CONTROL EQUIPMENT**
Steam injection apparatus (Patent), 3:21862

**INTERSTELLAR SPACE/STELLAR WINDS**
Interstellar bubbles. II. Structure and evolution, 3:22301

**IODEX PROCESS**
*See IODOX PROCESS*

**IODINE/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939

**IODINE 129/ADSORPTION**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)

**IODINE 131/ENVIRONMENTAL TRANSPORT**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208

**IODINE 131/RADIOECOLOGICAL CONCENTRATION**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208

**IODOX PROCESS/RESEARCH PROGRAMS**
Advanced fuel recycle program progress report, July 1-September 30, 1977, 3:21153 (ORNL/TM-6092)

**ION ACOUSTIC WAVES/COUPLING**
Modulation of randomly phased whistler wave packets by kinetic Alfven and ion quasi-modes in a magnetized plasma, 3:22521

**ION BEAM TYPE REACTORS**
*See I-BEAM TYPE REACTORS*

**ION EXCHANGE MATERIALS/SORPTIVE PROPERTIES**
Reaction of uranyl nitrate solutions with amberlite IRC-72 cation exchange resin at 30°C: a kinetic investigation for the HTGR fuel recycle plant, 3:21152 (ORNL/TM-5866)

**ION PLASMA WAVES/DISPERSION RELATIONS**
General dispersion relation for nonpotential ion harmonic waves propagating in plasmas with arbitrary $\beta$, 3:22507

**ION PLASMA WAVES/WAVE PROPAGATION**
General dispersion relation for nonpotential ion harmonic waves propagating in plasmas with arbitrary $\beta$, 3:22507

**ION RINGS/ACCELERATION**
Constant radius magnetic acceleration of a strong non-neutral proton ring, 3:22098

**ION SOURCES**
*See also ALPHA SOURCES*
*ELECTRON BEAM ION SOURCES*
*NEUTRAL BEAM SOURCES*
**ION SOURCES/BEAM EXTRACTION**
Acceleration of one ampere negative ion beams to energies up to 120 keV, 3:22614 (BNL-23391)
Focussing of an ion beam from a reflex triode, 3:22617 (COO-2765-7)
**ION SOURCES/MAGNETRONS**
Magnetron discharge as a source of H-ions, 3:22115
**ION SOURCES/PERFORMANCE**
Negative hydrogen ion sources for neutral beam injectors, 3:22613 (BNL-23389)
**IONOPHORESIS**
*See ELECTROPHORESIS*
**IONOSPHERE/ELECTRON DENSITY**
Study of the equatorial ionosphere. Interim scientific report No. 3, 1 January 1974-30 September 1976, 3:22307 (AD-A-042548)
**IONOSPHERE/SCINTILLATIONS**
Study of the equatorial ionosphere. Interim scientific report No. 3, 1 January 1974-30 September 1976, 3:22307 (AD-A-042548)
**IRELAND/NATURAL GAS INDUSTRY**
Developments in the Irish offshore industry, 3:20961
**IRELAND/PETROLEUM INDUSTRY**
Developments in the Irish offshore industry, 3:20961
**IRON/NEUTRON TRANSPORT**
Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM-6108)
**IRON/PHYSICAL RADIATION EFFECTS**
Sensitivity of primary knock-on atom spectra and displacement per atom cross sections to different secondary neutron energy and angular distributions and "in-group" weighting schemes, 3:22386 (ORNL/TM-6108)
**IRON/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**IRON 55/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**IRON 55/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**IRON ALLOYS**
*See also STEELS*
**IRON ALLOYS/SPECIFIC HEAT**
Low temperature heat capacity of scandium and alloys of scandium, 3:21882 (IS-T-780)
**IRON COMPLEXES**
*See also FERRITIN*
**IRON COMPLEXES/CHEMICAL BONDS**
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy (Ferric, manganous, cuprous, cupric, and vanadyl ion binding), 3:21976 (LBL-6682)
**IRON ORES/EXPLORATION**
Mineral exploration and mining in Brasil--1977, 3:20915
**IRON OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**IRON OXIDES/CHEMICAL REACTIONS**
Iron sponge treating of natural gas liquids, 3:21074 (CONF-7603113-)
**ISABELLE STORAGE RINGS/SECONDARY BEAMS**
Tables of particle fluxes, 3:22120 (BNL-23493)
**ISOBUTYL ALCOHOL**
*See 2-METHYLPROPANOL*
**ISOMERIC NUCLEI/SPONTANEOUS FISSION**
Spontaneously fissioning isomers, 3:22375
**ISOMERIZATION**
*See CHEMICAL REACTIONS*
**ISOTOPE ENRICHMENT**
*See ISOTOPE SEPARATION*
**ISOTOPE SEPARATION**
*(For separation of isotopes of the same element only.)*
*See also LASER ISOTOPE SEPARATION*
New advances in isotope separation, 3:21140 (COO-3498-30)

## J

**J-3105 RESONANCES**
*See PSI-3105 RESONANCES*
**JAERI FUSION TORUS-2A**
*See JFT-2A TOKAMAK*
**JAPAN/ENERGY SOURCE DEVELOPMENT**
Comprehensive studies on new energy development, 3:21386
Outline of the Sunshine Project, 3:21388
**JAPAN/GEOTHERMAL ENERGY**
Comprehensive studies on new energy development, 3:21386
**JAPAN/GEOTHERMAL EXPLORATION**
Studies of deep, widespread geothermal resources, 3:21409
Trends of geothermal power generation, 3:21397
**JAPAN/GEOTHERMAL FIELDS**
Plan for steam transport facilities at Kuzuneda geothermal power plant, 3:21446
**JAPAN/GEOTHERMAL POWER PLANTS**
Piping facilities for geothermal power stations, 3:21445
Trends of geothermal power generation, 3:21397
**JAPAN/SUNSHINE PROJECT**
Comprehensive studies on new energy development, 3:21386
Outline of the Sunshine Project, 3:21388
**JET ENGINE FUELS/COMBUSTION**
Effect of oxygen concentration on the rate of liquid phase oxidation of jet fuels, 3:21059
**JFT-2 TOKAMAK/ION TEMPERATURE**
Ion temperature scaling on Jaeri tokamaks, 3:22412
**JFT-2A TOKAMAK/ION TEMPERATURE**
Ion temperature scaling on Jaeri tokamaks, 3:22412
**JUPITER PLANET/PLANETARY MAGNETOSPHERES**
Application of nuclear techniques for measurements near Jupiter, 3:22306
**JUPITER PLANET/RADIATION FLUX**
Application of nuclear techniques for measurements near Jupiter, 3:22306

## K

**KEROGEN/CHEMICAL COMPOSITION**
Pyrolysis of Carpathian menilitic shales and production of cellular materials from them, 3:21106
Thermal decomposition of kuckersite shale in vacuum, 3:21107
**KEROGEN/PHYSICAL PROPERTIES**
Pyrolysis of Carpathian menilitic shales and production of cellular materials from them, 3:21106
**KEROSENE/COMBUSTION**
Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April-June 1977, 3:21172 (MLM-2463)
**KETONES/ABSORPTION SPECTROSCOPY**
Effect of pressure on the fluorescence and absorption of adamantanone, 3:21983
**KETONES/FLUORESCENCE SPECTROSCOPY**
Effect of pressure on the fluorescence and absorption of adamantanone, 3:21983
**KETONES/SYNTHESIS**
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data, 3:20870
**KILAUEA VOLCANO/ELECTROMAGNETIC SURVEYS**
Mapping lateral boundaries of a cooling basaltic lava lake using ELF and VLF induction techniques, Kilauea Iki, Hawaii, 3:21406
**KILAUEA VOLCANO/MAGNETOTELLURIC SURVEYS**
Magnetotelluric measurements over Kilauea Iki lava lake, 3:21405
**KILAUEA VOLCANO/SEISMIC SURVEYS**
Fine-mesh passive seismic survey of Kilauea Iki lava lake, 3:21452
Mapping a magma reservoir by locating thermal cracks, 3:21407
**KILNS/FUEL FEEDING SYSTEMS**
Coal firing technology for existing side fired tunnel kilns, 3:21807 (CONF-770658-)
Experiences in tunnel-kiln coal firing and related pollution control, 3:21811 (CONF-770658-)
**KILNS/POLLUTION CONTROL EQUIPMENT**
Experiences in tunnel-kiln coal firing and related pollution control, 3:21811 (CONF-770658-)
**KINK INSTABILITY/INSTABILITY GROWTH RATES**
Macroscopic kink instabilities in toroidal relativistic beams, 3:22491
**KINK INSTABILITY/KINETIC EQUATIONS**
Energy principle and the kink instability in a toroidal plasma with a strong magnetic field, 3:22488 (ORNL-tr-4410)
**KRYPTON/ATOM-MOLECULE COLLISIONS**
Quasiclassical trajectory study of the energy transfer in $CO_2$-rare gas systems, 3:22319

**KRYPTON 81/SCINTISCANNING**
Alternative displays in nuclear medicine, 3:22243
**KRYPTON 85/RADIOACTIVE WASTE DISPOSAL**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**KRYPTON 86 REACTIONS/COMPOUND-NUCLEUS REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
Experimental study of Yb nuclei at high angular momentum, 3:22369
**KRYPTON 86 REACTIONS/FUSION REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**KRYPTON IONS/ELECTRONIC STRUCTURE**
Electronic states of $Ar^+_2$, $Kr^+_2$, $Xe^+_2$. I. Potential curves with and without spin-orbit coupling, 3:22308

## L

**LAKE ERIE/AQUATIC ORGANISMS**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**LAKE ERIE/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**LAKE ERIE/SEDIMENTS**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**LAKE MICHIGAN/WATER POLLUTION**
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**LAKE ONTARIO/AQUATIC ORGANISMS**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**LAKE ONTARIO/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**LAKE ONTARIO/SEDIMENTS**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**LAMBDA NEUTRAL**
*See LAMBDA PARTICLES*
**LAMBDA PARTICLES/PARTICLE PRODUCTION**
Experimental study of $\Lambda p$ and $\Xi^0 p$ interactions in the range 1-10 GeV/c, 3:22337
**LAMELLAE/NEUTRON DIFFRACTION**
Correction factors for neutron diffraction from lamellar structures, 3:22388
**LAMPF LINAC/DATA PROCESSING**
Data analysis facility at LAMPF, 3:22118 (LA-7034-MS)
**LAMPF LINAC/ELECTRIC FIELDS**
LAMPF 201.25-MHz linac field distribution, 3:22103 (LA-6919)
**LAND LEASING**
Structure of the geothermal industry through 1974, 3:21426
**LAND POLLUTION ABATEMENT/COST BENEFIT ANALYSIS**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
**LAND POLLUTION ABATEMENT/EVALUATION**
Environmental protection issues facing the nation (Appraisal by GAO), 3:21688 (PB-269748)
**LAND RECLAMATION/LEGAL ASPECTS**
Geothermal resources operational Order No. 4: general environmental protection requirements, 3:21425
**LAND RECLAMATION/REVEGETATION**
Establishment, succession, and stability of vegetation on surface mined lands in eastern Montana. Annual progress report, June 1, 1975-February 29, 1976, 3:20914 (RLO/2228/T003-2)
**LAND USE**
Old field vegetation as an inhibitor of tree vegetation, 3:22199
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress (Recommended actions), 3:21692 (PB-269803)
**LAND USE/GOVERNMENT POLICIES**
Institutional barriers to geothermal energy development. Second report of the Institutional Barrier Panel to the Geothermal Advisory Council, 3:21420
**LAND USE/LEGISLATION**
Archaeological and historical investigations for energy facilities: a state of the art report, 3:21685 (TID-28070)
**LANTHANUM/SELF-DIFFUSION**
Anomalous self-diffusion in rare earths and actinides, 3:21892
**LANTHANUM/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**LANTHANUM 134/BETA-PLUS DECAY**
Decay of $^{134}$La, 3:22360 (TREE-1115)
**LANTHANUM 134/ELECTRON CAPTURE DECAY**
Decay of $^{134}$La, 3:22360 (TREE-1115)
**LANTHANUM ALLOYS/SORPTIVE PROPERTIES**
Low-temperature absorption equilibrium and chemisorption in the $LaNi_5$(activated)/$H_2$ system, 3:21254
**LANTHANUM OXIDES/REFRACTIVITY**
Refractive index and surface layers of ceramic $(Pb,La)(Zr,Ti)O_3$ compounds, 3:21904
**LARDERELLO GEOTHERMAL FIELD/ELECTRICAL SURVEYS**
Does temperature affect electric resistivity of rocks in the Larderello region, 3:21404 (NP-22319)
**LASER CAVITIES/FLUID FLOW**
Medium homogeneity in a chemical laser cavity using a lateral shearing interferometer. Technical report, 3:22017 (AD-A-042504)
**LASER FUSION REACTORS/BREEDING RATIO**
Energy partition and neutron spectra from laser fusion reactor targets, 3:22675
**LASER FUSION REACTORS/COMPUTER CALCULATIONS**
LASNEX code for inertial confinement fusion, 3:22651 (UCRL-80169)
**LASER FUSION REACTORS/COOLING SYSTEMS**
Liquid metal requirements for inertial confinement fusion, 3:22608 (UCRL-80424)
**LASER FUSION REACTORS/DESIGN**
Conceptual design of a laser fusion power plant, 3:22665
Laser design considerations for an inertially confined fusion reactor, 3:22666
**LASER FUSION REACTORS/ECONOMIC DEVELOPMENT**
Laser fusion deployment scenario, 3:22660
Requirements for commercialization of inertial confinement fusion, 3:22661
**LASER FUSION REACTORS/FEASIBILITY STUDIES**
Fluorescence-pumped selenium photolytic gas laser system for a commercial laser fusion power plant, 3:22664
NPL-NS: a "Next Step" experiment for inertial confinement fusion, 3:22636 (COO-2007-92)
**LASER FUSION REACTORS/FIRST WALL**
Temperature and displacement transients in inertial confinement fusion first walls, 3:22671
**LASER FUSION REACTORS/GAS LASERS**
Direct nuclear-pumped laser approaching feedback laser fusion needs, 3:22673
**LASER FUSION REACTORS/NEUTRON SPECTRA**
Energy partition and neutron spectra from laser fusion reactor targets, 3:22675
**LASER FUSION REACTORS/PLANNING**
Characterization of laser fusion reactor concepts, 3:22663
Laser fusion deployment scenario, 3:22660
**LASER FUSION REACTORS/RADIOACTIVE WASTE DISPOSAL**
Neutronic analysis of a laser-fusion-driven actinide waste burner, 3:22634
**LASER FUSION REACTORS/REVIEWS**
Laser induced thermonuclear fusion, 3:22659
**LASER FUSION REACTORS/SCALING LAWS**
Scaling of reactor cavity wall loads and stresses, 3:22674
**LASER FUSION REACTORS/SPECIFICATIONS**
Engineering design aspects for SOLASE, 3:22668
Laser, optics, and pellet design for SOLASE, 3:22669
SOLASE, a laser fusion reactor study, 3:22667
**LASER FUSION REACTORS/STRESS ANALYSIS**
Scaling of reactor cavity wall loads and stresses, 3:22674
**LASER FUSION REACTORS/THERMONUCLEAR FUELS**
Advanced fuel nuclear reaction feasibility using laser compression. I, 3:22658
Low aspect ratio double shells for high density and high gain, 3:22650 (UCRL-80104)
**LASER FUSION REACTORS/WALL LOADING**
Scaling of reactor cavity wall loads and stresses, 3:22638 (LA-7014-MS)
Scaling of reactor cavity wall loads and stresses, 3:22674
**LASER IMPLOSIONS**
Advanced fuel nuclear reaction feasibility using laser compression. II, 3:22657

**LASER IMPLOSIONS/COMPUTER CALCULATIONS**
PHD-IV, a laser-plasma simulation code, 3:22670
**LASER IMPLOSIONS/ELECTRON SPECTRA**
High energy electron spectra from 1.06 μm laser produced plasmas, 3:22654 (UCRL-80322(Summ.))
**LASER IMPLOSIONS/TIME DEPENDENCE**
Long pulse microsphere experiments at 3 TW, 3:22646 (UCRL-79779)
**LASER ISOTOPE SEPARATION/REVIEWS**
Laser isotope separation, 3:21143
**LASER RADIATION/MEASURING METHODS**
Filtered detector arrays for single pulsed photon measurements above 100 keV, 3:22653 (UCRL-80314)
**LASER RADIATION/MODULATION**
Optical rise-time measurements on KD*P transmission-line Pockels cells, 3:22036
Transient behavior of a nonlinear Fabry-Perot, 3:22029
**LASER RADIATION/THOMSON SCATTERING**
Status of the USA program on the development of submillimeter lasers to measure ion temperatures, 3:22419 (CONF-770954-5)
**LASER-PRODUCED PLASMA/ALPHA SPECTRA**
Pinhole imaging of laser-produced thermonuclear alpha particles, 3:22424 (UCRL-79780)
**LASER-PRODUCED PLASMA/COMPUTER CALCULATIONS**
LASNEX code for inertial confinement fusion, 3:22651 (UCRL-80169)
**LASER-PRODUCED PLASMA/ENERGY ABSORPTION**
Evidence of resonance absorption in laser-produced plasmas from the polarization and angular dependence of high-energy x-ray bremsstrahlung emission, 3:22472
**LASER-PRODUCED PLASMA/HEAT TRANSFER**
Enhanced transport across laser generated magnetic fields, 3:22458
**LASER-PRODUCED PLASMA/MASS SPECTROSCOPY**
Mass spectroscopic determination of plasma parameters in laser microplasmas of solids and their mathematical relationships, 3:22442 (IS-Trans-99)
**LASER-PRODUCED PLASMA/PLASMA DIAGNOSTICS**
Interferometry and luminosity measurements on a $CO_2$ laser plasma focus, 3:22426
Studies of pellet evaporation by $CO_2$ laser, using multiple-frame argon-ion laser shadow photography, 3:22434
**LASER-PRODUCED PLASMA/PLASMA EXPANSION**
Expansion of a laser-produced aluminium plasma and the heat penetration in multi-layered targets, 3:22475
**LASER-PRODUCED PLASMA/PLASMA WAVES**
Raman scattering and two-plasmon instability in laser-created plasmas, 3:22530
**LASER-PRODUCED PLASMA/RADIOWAVE RADIATION**
Emission of rf radiation from laser-produced plasmas, 3:22511
**LASER-PRODUCED PLASMA/RAYLEIGH-TAYLOR INSTABILITY**
Model of the Rayleigh-Taylor stability of an ablating fluid, 3:22479
**LASER-PRODUCED PLASMA/SCATTERING**
Raman scattering and two-plasmon instability in laser-created plasmas, 3:22530
**LASER-PRODUCED PLASMA/SHOCK WAVES**
Optical measurements of laser-detonated shock waves in thin lithium wires, 3:22473
Shock waves and ionizing radiation in plasmas produced by a mode-locked laser, 3:22474
**LASER-PRODUCED PLASMA/SOFT X RADIATION**
Conversion of laser radiation into x-rays in the subnanosecond region, 3:22656
**LASER-PRODUCED PLASMA/STREAK PHOTOGRAPHY**
Shock waves and ionizing radiation in plasmas produced by a mode-locked laser, 3:22474
**LASER-PRODUCED PLASMA/X-RAY EMISSION ANALYSIS**
Particle and x-ray energy measurements in laser-plasma interaction experiments, 3:22428
**LASER-PRODUCED PLASMA/X-RAY SPECTRA**
Spatial resolution of laser produced plasmas with x-ray crystals, 3:22440
Sub-keV, subnanosecond measurements of x-ray spectra from laser-produced plasmas, 3:22425 (UCRL-79782)
**LASER-RADIATION HEATING**
Resonant absorption in plasma density profiles produced by laser heating, heat flow, and hydrodynamics, 3:22459
**LASERS**
*See also CARBON DIOXIDE LASERS*
*CARBON MONOXIDE LASERS*
*DYE LASERS*
*GAS LASERS*
*NEODYMIUM LASERS*
*RUBY LASERS*
*SEMICONDUCTOR LASERS*
*SOLID STATE LASERS*
**LASERS/FEASIBILITY STUDIES**
Investigation of possibilities for solar powered high energy lasers in space. Final report, 3:22020 (N-77-26478)
**LASERS/MEETINGS**
Second international and winter school on submillimeter waves and their applications, 3:22067
**LASERS/OPTICAL PUMPING**
Laser pump development. Final report, 3:22025 (UCRL-13762)
**LASERS/PERFORMANCE**
Multilayer light scattering and the laser gyro, 3:22030
**LASERS/POWER**
System for calibrating laser power meters for the range 5-1000 W, 3:22023 (PB-269777)
**LASERS/REVIEWS**
Review of photo-pumped short wavelength lasers, 3:22024 (UCID-17629)
**LASERS/USES**
Industrial applications of high power laser technology, 3:22065
**LATTICES (CRYSTAL)**
*See CRYSTAL LATTICES*
**LEAD/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**LEAD/CHEMICAL ANALYSIS**
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**LEAD/CHEMICAL VAPOR DEPOSITION**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**LEAD/ECOLOGICAL CONCENTRATION**
Lead, expecially exhaust lead, in the terrestrial environment: accumulation and ecological effects. A literature survey, 3:22148 (SNV-PM-794)
**LEAD/ENVIRONMENTAL TRANSPORT**
Appendix to Environmental Measurements Laboratory environmental quarterly, 3:22205 (EML-334(App.))
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**LEAD/QUANTITATIVE CHEMICAL ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
Lunar sample studies, 3:21917 (N-77-27053)
**LEAD 208/CHARGE DISTRIBUTION**
Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$, 3:22354
**LEAD 208 TARGET/OXYGEN 16 REACTIONS**
Influence of intrinsic nucleon motion on energy spectra and angular distributions for $^{16}O$-induced reactions at 20 MeV/A, 3:22374
**LEAD 208 TARGET/PROTON REACTIONS**
Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$, 3:22354
Successive and simultaneous transfer descriptions of (p,t) reactions on $^{208}Pb$, 3:22371
**LEAD 210/RADIATION MONITORING**
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**LEAD 214/RADIATION MONITORING**
Estimation of $^{222}Rn$ daughter doses from large-area sources, 3:22195
Variation of radon and radon daughter concentrations with height above ground, 3:22177 (HASL-325)
**LEAD BASE ALLOYS/MIXED STATE**
Viscous drag on mobile dislocations in type-II superconductors, 3:21886
**LEAD OXIDES/PHASE DIAGRAMS**
Solid phases of the $Bi_2O_3$-PbO system: identification and evolution as a function of temperature, 3:21900 (SAND-77-6024)
**LEAD OXIDES/REFRACTIVITY**
Refractive index and surface layers of ceramic $(Pb,La)(Zr,Ti)O_3$ compounds, 3:21904
**LEAD SULFIDES/ABSORPTIVITY**
Selective absorption properties of lead sulfide-aluminum coatings as a function of lead sulfide thickness, 3:21371
**LEAD SULFIDES/EMISSIVITY**
Selective absorption properties of lead sulfide-aluminum coatings as a function of lead sulfide thickness, 3:21371
**LEAD SULFIDES/REFLECTIVITY**
Selective absorption properties of lead sulfide-aluminum coatings as a function of lead sulfide thickness, 3:21371
**LEAST SQUARE FIT/RECOMMENDATIONS**
Fitting noisy data with a complex exponential series, 3:22694 (UCRL-52242)

**LETHAL GENES/BIOLOGICAL EFFECTS**
Average number of generations until extinction and rate of allelism of lethal genes in a sub-divided population (Drosophila), 3:22239 (RLO/2225/T5-35)
**LETTUCE/GROWTH**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**LEUKEMIA/ETIOLOGY**
Discrepancy in XC and oncogenicity assays for murine leukemia virus in AKR mice, 3:22245
**LEUKEMIA VIRUS**
*See ONCOGENIC VIRUSES*
**LEVITRON DEVICES/CHARGED-PARTICLE TRANSPORT**
Electrostatic potential in a low-density plasma in toroidal systems, 3:22464
**LEWIS ACIDS/CHEMICAL REACTIONS**
Desulfurization of petroleum residues and their carbonization properties, 3:20985
**LI-DRIFTED SI DETECTORS/PERFORMANCE TESTING**
Measuring low concentrations of plutonium and americium in earth samples, 3:22202
**LIGHT**
*See VISIBLE RADIATION*
**LIGNITE/PRODUCTION**
Bituminous coal and lignite distribution. Calendar year 1976, 3:20934
**LINACS**
*See LINEAR ACCELERATORS*
**LINEAR ACCELERATORS**
*See also LAMPF LINAC*
**LINEAR ACCELERATORS/BEAM DYNAMICS**
Increase of the beam radius and particle oscillations due to errors in proton linear accelerators, 3:22106 (LA-tr-77-89)
**LINEAR ACCELERATORS/BEAM PRODUCTION**
High-current, high pulse rate electron accelerator with inductive energy storage, 3:22101
**LINEAR ACCELERATORS/RF SYSTEMS**
Fast accelerating field stabilization systems for the accelerator resonators of the meson factory, 3:22112 (LA-tr-77-93)
Systems of RF field stabilization and coherent-oscillation suppression in the linac first stage, 3:22113 (LA-tr-77-40)
**LINEAR THETA PINCH DEVICES/MICROWAVE RADIATION**
Possible mechanism of microwave emission from a theta-pinch discharge in presence of a superimposed azimuthal magnetic field, 3:22514
**LINEAR THETA PINCH DEVICES/PLASMA WAVES**
Possible mechanism of microwave emission from a theta-pinch discharge in presence of a superimposed azimuthal magnetic field, 3:22514
**LINEAR Z PINCH DEVICES/ELECTRIC DISCHARGES**
High-current pinches in xenon. II. Z pinch, 3:22413
**LINERS/THERMAL STRESSES**
Thermal responses of tokamak reactor first walls during cyclic plasma burns, 3:22577 (CONF-771029-189)
**LINUS REACTOR/REVIEWS**
Conceptual LINUS fusion reactor, 3:22566
**LIPIDS**
*See also LIPOPROTEINS*
**LIPIDS/BIOSYNTHESIS**
Sphaerococcenol A: a new rearranged bromo-diterpene from the red alga Sphaerococcus coronopifolius, 3:22240
**LIPOPROTEINS/CHEMICAL PROPERTIES**
Structure of human serum lipoproteins in solution. II. Small-angle x-ray scattering study of $HDL_3$ and LDL, 3:22232
**LIQUEFIED NATURAL GAS/CALORIFIC VALUE**
Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring, 3:21097
**LIQUEFIED NATURAL GAS/CALORIMETRY**
Calorific value determination of liquefied hydrocarbon gases by capacity measuring, 3:21098
**LIQUEFIED NATURAL GAS/DIELECTRIC PROPERTIES**
Calorific value determination of liquefied hydrocarbon gases by capacity measuring, 3:21098
Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring, 3:21097
**LIQUEFIED NATURAL GAS/EVAPORATION**
Process and equipment employed in the vaporisation and conditioning units of the Nievenheim LPG plant, 3:21078
**LIQUEFIED NATURAL GAS/MARITIME TRANSPORT**
LNG transport costs cut by concrete, 3:21094
Situation on the LNG tanker market, 3:21092
**LIQUEFIED NATURAL GAS/MEASURING METHODS**
Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring, 3:21097
**LIQUEFIED NATURAL GAS/PRODUCTION**
New development of the Tealarc natural gas liquefaction process, 3:21085
Technical and economic development trends in the gas supply industry, 3:21090
**LIQUEFIED NATURAL GAS/STORAGE**
Technical and economic development trends in the gas supply industry, 3:21090
**LIQUEFIED NATURAL GAS/TRADE**
Technical and economical aspects of the LNG market, 3:21787
**LIQUEFIED PETROLEUM GASES/CALORIFIC VALUE**
Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring, 3:21097
**LIQUEFIED PETROLEUM GASES/CALORIMETRY**
Calorific value determination of liquefied hydrocarbon gases by capacity measuring, 3:21098
**LIQUEFIED PETROLEUM GASES/CHARGES**
LPG/energy-value relationships, 3:21003 (CONF-770375-)
**LIQUEFIED PETROLEUM GASES/DIELECTRIC PROPERTIES**
Calorific value determination of liquefied hydrocarbon gases by capacity measuring, 3:21098
Determination of the calorific value of liquefied hydrocarbon gases by capacity measuring, 3:21097
**LIQUEFIED PETROLEUM GASES/TRADE**
LPG/energy-value relationships, 3:21003 (CONF-770375-)
**LIQUID ASPHALT**
*See RESIDUAL FUELS*
**LIQUID METAL FAST BREEDER REACTORS**
*See LMFBR TYPE REACTORS*
**LIQUID METAL TEST FACILITIES**
*See TEST FACILITIES*
**LIQUID WASTES**
*See also WASTE WATER*
**LIQUID WASTES/RADIOACTIVITY**
Environmental radioactivity from hospitals, 3:22226
**LIQUID WASTES/WATER CHEMISTRY**
Simulation of chlorinated water discharges from power plants on estuaries and rivers, 3:22216
**LIQUIDS/NUCLEATE BOILING**
Nucleate boiling at a liquid-liquid interface, 3:22071
**LITHIUM/CORROSIVE EFFECTS**
Corrosion resistance of vanadium and vanadium alloys as structural materials in a lithium cooled fusion reactor, 3:21893
**LITHIUM/LEAKS**
HEDL magnetic fusion energy programs. Progress report, April-June 1977, 3:22681 (HEDL-TME-77-81)
**LITHIUM/PRODUCTION**
Investigation of a lithium electrolytic cell failure, 3:21986 (Y-2107)
**LITHIUM ALLOYS/TRITIUM RECOVERY**
Recovery of tritium from solid Li-Al and sintered aluminum product (SAP) blanket materials, 3:22635
**LITHIUM COMPOUNDS/LATTICE PARAMETERS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**LITHIUM COMPOUNDS/SYNTHESIS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**LITHIUM-SULFUR BATTERIES/ELECTROLYTES**
High temperature battery requirements put ceramics through their paces, 3:21676
**LITHIUM-SULFUR BATTERIES/MANUFACTURING**
High temperature battery requirements put ceramics through their paces, 3:21676
**LIVER/QUANTITATIVE CHEMICAL ANALYSIS**
Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis (Environmental pollution during fossil fuel combustion), 3:22276 (EML-334)
**LIVESTOCK**
*See DOMESTIC ANIMALS*
**LMFBR TYPE REACTORS**
*See also CLINCH RIVER BREEDER REACTOR*
*FFTF REACTOR*
*PLBR REACTOR*
**LMFBR TYPE REACTORS/BOILING DETECTION**
Acoustic emission in subcooled nucleate pool boiling, 3:21591
**LMFBR TYPE REACTORS/BREEDING BLANKETS**
MIT LMFBR blanket research project. Quarterly progress report, July 1, 1977-September 30, 1977, 3:21580 (COO-2250-30)
**LMFBR TYPE REACTORS/FAILED ELEMENT MONITORS**
Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME-77-38)
**LMFBR TYPE REACTORS/FUEL ELEMENT CLUSTERS**
Temperature, flow, and acoustic noises in a locally blocked 37-pin bundle, 3:21592 (JAPFNR-263)
Transient boiling of sodium in a 19-pin bundle under loss-of-flow conditions, 3:21658 (JAPFNR-262)
**LMFBR TYPE REACTORS/FUEL-COOLANT INTERACTIONS**
Evaluation of effects of finite mixing time and non-condensable gas on fuel-sodium interactions, 3:21656

**LMFBR TYPE REACTORS/PRIMARY COOLANT CIRCUITS**
Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME-77-38)
**LMFBR TYPE REACTORS/REACTOR ACCIDENTS**
Compendium of computer codes for the safety analysis of fast breeder reactors, 3:21636 (DOE/ET-0009)
**LMFBR TYPE REACTORS/REACTOR COMPONENTS**
Sodium engineering and technology. Technical progress report, April, May, June 1977, 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977, 3:21586 (HEDL-TME-77-38)
**LMFBR TYPE REACTORS/REACTOR COOLING SYSTEMS**
Signal analysis method using cross-correlation of turbulence flow signals to determine calibration of permanent magnet sodium flowmeters, 3:21579 (CONF-771023-23)
Standpipe-bubbler pump level control study system design layout (Task A) W.P. 4413. Engineering memorandum No. 0153, 3:21589 (TID-27895)
**LMFBR TYPE REACTORS/REACTOR CORE DISRUPTION**
Flow visualization in heat-generating porous media, 3:21644 (SAND-76-0614)
Source term assessment concepts for LMFBRS: Aerosol Release and Transport (ART) Analytical Program, 3:21643 (ORNL/NUREG/TM-124)
**LMFBR TYPE REACTORS/REACTOR MATERIALS**
Introduction to materials consideration for LMFBR components, 3:21593
**LNG**
*See LIQUEFIED NATURAL GAS*
**LNG PLANTS/COMPRESSORS**
Process and machine technology used in vaporization and conditioning units of Nievenheim Liquefied Natural Gas Plant, 3:21079
**LNG PLANTS/CONSTRUCTION**
New development of the Tealarc natural gas liquefaction process, 3:21085
**LNG PLANTS/DESIGN**
Molecular sieve dehydration and treating in expander plants: update, 3:21069 (CONF-7603113-)
New development of the Tealarc natural gas liquefaction process, 3:21085
**LNG PLANTS/OPERATION**
Molecular sieve dehydration and treating in expander plants: update, 3:21069 (CONF-7603113-)
**LOAD MANAGEMENT/MATHEMATICAL MODELS**
Voltage and reactive production programming in an electric system. II. Notes on mathematical models of generators and loads, 3:21511
**LOCAL GALAXY**
*See MILKY WAY*
**LOFT REACTOR/ECCS**
LOFT emergency core-cooling system experiments: results from the L1-4 experiment, 3:21652
**LOFT REACTOR/ELECTRIC CABLES**
Impedance calculations for power cables to primary coolant pump motors, 3:21562 (LTR-1310-17)
**LOFT REACTOR/REACTOR OPERATION**
Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, July-September 1977, 3:21648 (TREE-NUREG-1188)
**LONGWALL MINING**
*See also COAL MINING*
**LONGWALL MINING/MINING EQUIPMENT**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**LONGWALL MINING/SIMULATION**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**LOS ALAMOS MESON PHYSICS FACILITY**
*See LAMPF LINAC*
**LOSS CONE INSTABILITY/DISPERSION RELATIONS**
Electromagnetic instabilities in an anisotropic loss-cone plasma, 3:22499
**LOSS OF COOLANT**
Posttest REALP4 analysis of LOFT experiment L1-3A, 3:21646 (TREE-NUREG-1137)
**LOSS OF COOLANT/HEAT TRANSFER**
Experiment data report for semiscale Mod-1 test S-06-4 (LOFT counterpart test), 3:21645 (TREE-NUREG-1124)
Investigation of variation of the parameters of a medium in a pressurized space after loss of tightness in a high-pressure loop, 3:21660
**LOSS OF COOLANT/HYDRAULICS**
Experiment data report for semiscale Mod-1 test S-06-4 (LOFT counterpart test), 3:21645 (TREE-NUREG-1124)
One-Third-Scale Air-Water Pump Program: test program and pump performance (BWR, PWR), 3:21637 (EPRI-NP-135)
**LOSS OF COOLANT/PRESSURE SUPPRESSION**
BWR Mark I pressure suppression study: bench mark experiments, 3:21649 (UCID-17661)
BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function, 3:21650 (UCID-17662)
Suppression pool dynamics. Quarterly progress report, April 1-June 30, 1977 (BWR), 3:21642 (NUREG-0264-4)
**LOSS OF COOLANT/SIMULATION**
Experiment data report for semiscale Mod-1 test S-28-4 (steam generator tube rupture test), 3:21647 (TREE-NUREG-1151)
Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, July-September 1977, 3:21648 (TREE-NUREG-1188)
**LOSS OF FLOW/SIMULATION**
Transient boiling of sodium in a 19-pin bundle under loss-of-flow conditions, 3:21658 (JAPFNR-262)
**LOSS OF FLUID TEST REACTOR**
*See LOFT REACTOR*
**LP-GAS**
*See LIQUEFIED PETROLEUM GASES*
**LUBRICATING OILS**
*See also WASTE OILS*
**LUBRICATING OILS/ADDITIVES**
Effect of polymeric additives and viscous oil components on varnish-forming properties of all-season oils, 3:20998
**LUBRICATING OILS/AVAILABILITY**
Future world demand and supply trends in the lubricating oil industry, 3:21734
**LUBRICATING OILS/PRODUCTION**
High-v.i. lubricating oil produced by adsorptive treatment of heavy catalytic gas oil, 3:21001
**LUBRICATING OILS/RECYCLING**
Turbo proposes new refinery concept, 3:20990
**LUNAR MATERIALS/CHEMICAL ANALYSIS**
Lunar sample studies, 3:21917 (N-77-27053)
**LUNGS/BIOLOGICAL RADIATION EFFECTS**
Cancer induction by alpha emitting warm particles, 3:22254
Exposure to radon daughters and the incidence of lung cancer, 3:22256
**LUNGS/RADIATION INJURIES**
Estimate of early mortality and morbidity following acute inhalation of plutonium, 3:22255
**LUNGS/SCINTISCANNING**
Alternative displays in nuclear medicine, 3:22243

## M

**MAGMA/CHEMICAL PROPERTIES**
Sandia/USGS magma workshop (Recommendation for exploration in US), 3:21401
**MAGMA/GEOLOGY**
Sandia/USGS magma workshop (Recommendation for exploration in US), 3:21401
**MAGMA SYSTEMS/GEOPHYSICAL SURVEYS**
Sandia/USGS magma workshop (Recommendation for exploration in US), 3:21401
**MAGMA SYSTEMS/SEISMIC SURVEYS**
Mapping a magma reservoir by locating thermal cracks, 3:21407
**MAGNESIUM/CHEMICAL VAPOR DEPOSITION**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**MAGNESIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**MAGNESIUM ALLOYS/MAGNETIC SUSCEPTIBILITY**
Magnetic properties of zinc and of cadmium alloys with magnesium and with mercury, 3:21890
**MAGNESIUM COMPOUNDS/LATTICE PARAMETERS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**MAGNESIUM COMPOUNDS/SYNTHESIS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967

**MAGNET COILS/FATIGUE**
Evaluation of the fatigue resistance of CDA 182 copper for use in the impurity study experiment fusion research tokamak (ISX) (CDA 182 copper), 3:22682 (ORNL-5302)
**MAGNET COILS/SPECIFICATIONS**
Compact high-field ignition test reactor (HFITR) using bitter magnets, 3:22600
**MAGNETIC COILS**
*See MAGNET COILS*
**MAGNETIC COMPRESSION**
High power pulse compression techniques (Patent), 3:22606
**MAGNETIC COMPRESSION/TWO-DIMENSIONAL CALCULATIONS**
Numerical methods for studying compressed magnetic field generators, 3:22599
**MAGNETIC FIELDS/BIOLOGICAL EFFECTS**
Biologic effects of electric and magnetic fields associated with proposed Project Seafarer, 3:22280 (AD-A-042515)
**MAGNETIC FIELDS/HEAT TRANSFER**
Enhanced transport across laser generated magnetic fields, 3:22458
**MAGNETIC MIRROR TYPE REACTORS**
*See also TMX DEVICES*
**MAGNETIC MIRROR TYPE REACTORS/DESIGN**
Mirror hybrid (fusion-fission) reactor, 3:22542 (UCRL-80076)
**MAGNETIC MIRROR TYPE REACTORS/MAGNETIC FIELD CONFIGURATIONS**
Second-generation design calculations of the field-reversed mirror reactor, 3:22627
**MAGNETIC MIRROR TYPE REACTORS/MAGNETIC FIELD REVERSAL**
Reassessment of the requirements to obtain field reversal in mirror machines, 3:22596 (UCID-17691)
**MAGNETIC MIRROR TYPE REACTORS/MAINTENANCE**
Remote servicing features of two new mirror fusion reactors, 3:22686
**MAGNETIC MIRROR TYPE REACTORS/MECHANICAL STRUCTURES**
Mechanical structure of the mirror hybrid reactor power plant, 3:22575
**MAGNETIC MIRROR TYPE REACTORS/NEUTRAL ATOM BEAM INJECTION**
Second-generation design calculations of the field-reversed mirror reactor, 3:22627
**MAGNETIC MIRROR TYPE REACTORS/NEUTRAL BEAM SOURCES**
Engineering problems of future neutral beam injectors, 3:22620 (UCRL-80384)
Neutral beam requirements for mirror reactors, 3:22622 (UCRL-80408)
**MAGNETIC MIRROR TYPE REACTORS/PLASMA HEATING**
Alpha particle effects on the reversal field mirror, 3:22417
**MAGNETIC MIRROR TYPE REACTORS/REMOTE HANDLING**
Remote servicing features of two new mirror fusion reactors, 3:22686
**MAGNETIC MIRROR TYPE REACTORS/RESEARCH PROGRAMS**
Mirror machine program in the USA, 3:22540 (UCRL-79870)
**MAGNETIC MIRROR TYPE REACTORS/REVIEWS**
Mirror machine program in the USA, 3:22540 (UCRL-79870)
**MAGNETIC MIRROR TYPE REACTORS/SPECIFICATIONS**
Mechanical structure of the mirror hybrid reactor power plant, 3:22575
**MAGNETIC MIRROR TYPE REACTORS/TOROIDAL CONFIGURATION**
Advanced fuel bumpy tori, 3:22564
**MAGNETIC MIRRORS**
*See also 2X DEVICES*
**MAGNETIC MIRRORS/ELECTRON BEAM INJECTION**
Formation of strong E-layers by intense electron-beam injection into preformed plasmas, 3:22406
**MAGNETOACOUSTIC WAVES**
Determination of plasma density and temperature profiles using magneto-acoustic oscillations, 3:22436
**MAGNETOHYDRODYNAMIC CHANNELS**
*See MHD CHANNELS*
**MAGNETOHYDRODYNAMIC GENERATORS**
*See MHD GENERATORS*
**MAGNETOHYDRODYNAMICS/COMPUTER CALCULATIONS**
U-25-C MHD channel analysis open circuit operation. Interim report: Subtask 1 (B). Revision A, 3:21764 (FE-2243-9)
**MAGNETOHYDRODYNAMICS/PULSATIONS**
Dependence of current density and intensity of electric field on pulsation of thermodynamic parameters of plasma in a MHD generator, 3:21756
**MAKI PARAMETER**
*See GINZBURG-LANDAU THEORY*
**MALES/CARDIOVASCULAR DISEASES**
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22246
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247
**MALES/MYOCARDIAL INFARCTION**
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22246
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247
**MAN**
*See also PERSONNEL*
**MAN/EARLY RADIATION EFFECTS**
Estimate of early mortality and morbidity following acute inhalation of plutonium, 3:22255
**MAN/HEALTH HAZARDS**
Inhalation of dust contaminated with plutonium: Possible health effects. Health considerations of proposed residential development of land contaminated with plutonium in the Denver area, 3:21210 (HRP-0006798)
**MANAGEMENT**
*See also ENERGY MANAGEMENT*
*LOAD MANAGEMENT*
*NUCLEAR MATERIALS MANAGEMENT*
**MANAGEMENT/COMPUTER CODES**
Proposal for development of an interactive project management code, 3:22688 (UCID-17613)
**MANGANESE/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**MANGANESE 54/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**MANGANESE CHLORIDES/HYDROLYSIS**
Hydrolysis of manganeous chloride, 3:21946
**MANGANESE COMPLEXES/CHEMICAL BONDS**
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy (Ferric, manganous, cuprous, cupric, and vanadyl ion binding), 3:21976 (LBL-6682)
**MANGANESE COMPOUNDS/CRYSTAL STRUCTURE**
Crystal structure of $Mn_3[Co(CN)_6]_2.12H_2O$ and $Cd_3[Co(CN)_6]_2.12H_2O$ by neutron and x-ray diffraction, 3:21956
**MANGANESE OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**MANURES/CHEMICAL COMPOSITION**
Conversion of biomass materials into gaseous products. Bimonthly technical status report, December 15, 1976-February 15, 1977, 3:21306 (CONF-770235-)
**MANURES/COMBUSTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration). 3:21258 (SAN-1261/1)
Conversion of biomass materials into gaseous products. Bimonthly technical status report, December 15, 1976-February 15, 1977, 3:21306 (CONF-770235-)
**MANURES/GASIFICATION**
Application of SGFM technology to other feedstocks: status report, 3:21304 (CONF-770235-)
**MANURES/PYROLYSIS**
Conversion of biomass materials into gaseous products. Bimonthly technical status report, December 15, 1976-February 15, 1977, 3:21306 (CONF-770235-)
**MARINE ECOSYSTEMS**
*See AQUATIC ECOSYSTEMS*
**MARKOV PROCESS**
Almost-periodic Markov processes, 3:22696 (UCRL-Trans-11303)
**MARYLAND/OIL SPILLS**
Maryland's experience in oil spill prevention and control, 3:21027
**MASERS**
Cyclotron masers (gyrotrons) as potent millimetre-wave sources, 3:22409
**MASKS**
*See RESPIRATORS*
**MASS SPECTRA/CALCULATION METHODS**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**MASS SPECTROMETERS/AUTOMATION**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**MATERIALS/DATA COMPILATION**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR-77-1314)
**MATERIALS/FIRE RESISTANCE**
Flame resistance for plastics and chemical fibers, 3:22076
**MATERIALS/STANDARDS**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR-77-1314)

**MATERIALS/STRESS ANALYSIS**
Effect of material constitutive models on stress wave propagation calculations, 3:22003
**MATERIALS DRILLING/ACOUSTIC MONITORING**
Role of ion aggregates in Rebinder-Westwood environmental effects on wear as monitored by acoustic emission, 3:22072
**MATERIALS DRILLING/ENVIRONMENTAL EFFECTS**
Role of ion aggregates in Rebinder-Westwood environmental effects on wear as monitored by acoustic emission, 3:22072
**MEDICAL CENTERS/ICES**
State of the art for integrated Energy/Utility Systems, 3:21849 (PB-269684)
**MERCAPTANS**
*See THIOLS*
**MERCURY ALLOYS/MAGNETIC SUSCEPTIBILITY**
Magnetic properties of zinc and of cadmium alloys with magnesium and with mercury, 3:21890
**MERCURY COMPOUNDS/ORDER-DISORDER TRANSFORMATIONS**
One-dimensional phonons and "phase-ordering" phase transition in a Hg-As-F compound, 3:21914
**MERCURY COMPOUNDS/PHYSICAL RADIATION EFFECTS**
Electrical and recombination characteristics of Cd/sub x/Hg/sub 1-x/Te irradiated with electrons at T=300° K, 3:21897
**MESON FACTORIES/RF SYSTEMS**
Fast accelerating field stabilization systems for the accelerator resonators of the meson factory, 3:22112 (LA-tr-77-93)
Systems of RF field stabilization and coherent-oscillation suppression in the linac first stage, 3:22113 (LA-tr-77-40)
**MESON-NUCLEON INTERACTIONS/REGGE TRAJECTORIES**
Possible connections between hard and soft processes, 3:22347 (SLAC-PUB-2051)
**MESONS/BOUNDARY CONDITIONS**
Chiral symmetry breaking and the quark model: unification of baryon and meson constraints (Review), 3:22352
**MESONS/MASS SPECTRA**
Chiral symmetry breaking and the quark model: unification of baryon and meson constraints (Review), 3:22352
**MESONS/REVIEWS**
Theoretical review of strange and nonstrange mesons, 3:22350 (FERMILAB-Conf-77/65-THY)
**METAL INDUSTRY**
*See also MINERAL INDUSTRY*
**METAL INDUSTRY/ENERGY CONSERVATION**
Assessment of current practice with regard to charge preheating in electrometallurgy, 3:21838
**METAL INDUSTRY/ENERGY CONSUMPTION**
Energy efficiency improvement targets in the machinery (except electrical) industry, SIC 35. Industrial programs conservation and environment. Volume I, 3:21829 (PB-269887)
Energy efficiency improvement targets in the machinery (except electrical) industry, SIC 35. Volume 2. Target support document, 3:21830 (PB-269888)
Energy efficiency improvement targets in machinery (except electrical) industry, SIC 35. Volume 3. Final target document, 3:21831 (PB-269889)
**METAL-NONMETAL BATTERIES**
*See also SODIUM-SULFUR BATTERIES*
**METAL-NONMETAL BATTERIES/CATHODES**
Electrochemical cell, 3:21673
**METAL-NONMETAL BATTERIES/ELECTROLYTES**
Electrochemical cell, 3:21673
**METALS**
*See also ACTINIDES*
**METALS/ECOLOGICAL CONCENTRATION**
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**METALS/EVAPORATION**
Chemical equilibrium in ash-laden coal combustion systems, 3:20890 (FE-2205-7)
**METALS/GAS CHROMATOGRAPHY**
Spectroscopic element detector for gas chromatography, 3:21929
**METALS/MATERIALS RECOVERY**
No tipping: service included in waste burning plant, 3:22083
**METALS/PHYSICAL RADIATION EFFECTS**
Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
**METALS/SPECTROSCOPY**
Spectroscopic element detector for gas chromatography, 3:21929
**METALS/THERMAL CONDUCTION**
Flow of heat between bodies in gas-filled contact, 3:22069
**METALS/WEAR RESISTANCE**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**METHANE/BIOSYNTHESIS**
Methane gas process and apparatus (Patent), 3:21260
Solar powered anaerobic wastewater treatment plant, 3:21361
Swedish methane gas project: a proposal with three alternatives, 3:21262
**METHANE/DEW POINT**
Dew-point loci for methane-toluene system, 3:21256 (CONF-770375-)
**METHANE/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**METHANE/INTERMOLECULAR FORCES**
Chemical applications of molecular quantum theory, 3:21947 (LBL-6699)
**METHANE/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**METHANOL/AUTOMOTIVE FUELS**
Methanol as an automotive fuel, 3:21869
**METHANOL/COST**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**METHANOL/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**METHANOL/SYNTHESIS**
Economic pre-feasibility study: large-scale methanol fuel production from surplus Canadian forest biomass. Part 2. Working papers, 3:21310 (NP-22159/2)
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**METHANOL/USES**
Methanol from natural gas for engine fuel. 2nd interim report. Report No. 23, 3:21868 (NP-22771)
**METHANOL/VIBRATIONAL STATES**
Studies of the hydrogen bonded structures of water and methanol, 3:21948 (ORO-1797-76)
**METHYL IODIDE/ADSORPTION**
Activation of water-soluble amines by halogenes for catching radioactive iodine out of air streams (Patent), 3:21176
**METHYL PHENOLS**
*See CRESOLS*
**METHYLAMINE/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**METHYLBENZENE**
*See TOLUENE*
**METHYLENE RADICALS/ELECTRONIC STRUCTURE**
Structure and energetics of simple carbenes $CH_2$, CHF, CHCl, CHBr, $CF_2$, and $CCl_2$, 3:21981
**METHYLIDENE RADICALS**
*See METHYLENE RADICALS*
**2-METHYLPROPANOL/CHEMICAL COMPOSITION**
Investigation of the effect of pressure on the composition of binary azeotropes, aromatic hydrocarbon $c_8$-isobutyl alcohol, 3:20999
**MFTF DEVICES/CONVECTIVE INSTABILITIES**
Detection and measurement of Post-Rosenbluth convective instability in MFTF with a hybrid $CO_2$ laser-heterodyne diagnostic system, 3:22423 (UCRL-52339)
**MFTF DEVICES/DESIGN**
Directions for possible upgrades of the Mirror Fusion Test Facility (MFTF), 3:22543 (UCRL-80475)
**MFTF DEVICES/LOSS CONE INSTABILITY**
Detection and measurement of Post-Rosenbluth convective instability in MFTF with a hybrid $CO_2$ laser-heterodyne diagnostic system, 3:22423 (UCRL-52339)
**MFTF DEVICES/NEUTRAL ATOM BEAM INJECTION**
Directions for possible upgrades of the Mirror Fusion Test Facility (MFTF), 3:22543 (UCRL-80475)
**MFTF DEVICES/PLASMA DIAGNOSTICS**
Detection and measurement of Post-Rosenbluth convective instability in MFTF with a hybrid $CO_2$ laser-heterodyne diagnostic system, 3:22423 (UCRL-52339)
**MHD CHANNELS/COMPUTER CALCULATIONS**
U-25-C MHD channel analysis open circuit operation. Interim report: Subtask 1 (B). Revision A, 3:21764 (FE-2243-9)
**MHD CHANNELS/ELECTRODES**
Magnetohydrodynamic electrode (Patent; ceramic-metal composite), 3:21762
**MHD CHANNELS/HALL EFFECT**
Experimental determination of the Hall parameter from the local characteristics of a MHD generator, 3:21768
**MHD CHANNELS/HEAT TRANSFER**
Combined influence of Hall effect, ion slip and temperature boundary condition of third kind on MHD channel flow heat transfer, 3:21766

**MHD CHANNELS/MAGNETIC FIELDS**
Development program for MHD power generation. Quarterly report, October 1976-December 1976, 3:21753 (FE-2015-21)
**MHD CHANNELS/PERFORMANCE TESTING**
Development program for MHD power generation. Quarterly report, April 1976-June 1976, 3:21752 (FE-2015-12)
**MHD CHANNELS/PLASMA MACROINSTABILITIES**
High magnetic field MHD generator program. Quarterly report, January-March 1977, 3:21765 (FE-2341-2)
**MHD CHANNELS/PRESSURE DROP**
High magnetic field MHD generator program. Quarterly report, January-March 1977, 3:21765 (FE-2341-2)
**MHD GENERATORS**
*See also COAL-FIRED MHD GENERATORS*
*OPEN-CYCLE MHD GENERATORS*
**MHD GENERATORS/COMBUSTION CHAMBERS**
Investigation of the combustion chamber of an experimental MHD generator and some problems of updating, 3:21763
**MHD GENERATORS/COMPUTER CALCULATIONS**
U-25-C MHD channel analysis open circuit operation. Interim report: Subtask 1 (B). Revision A, 3:21764 (FE-2243-9)
**MHD GENERATORS/ELECTRODES**
Magnetohydrodynamic electrode (Patent; ceramic-metal composite), 3:21762
**MHD GENERATORS/HEAT EXCHANGERS**
Numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature, 3:21760 (N-77-26439)
**MHD GENERATORS/MAGNETIC FIELDS**
High magnetic field MHD generator program. Quarterly report, January-March 1977, 3:21765 (FE-2341-2)
**MHD GENERATORS/NON-EQUILIBRIUM PLASMA**
Energy estimates of nonequilibrium ionization using external sources in MHD generator channel, 3:21767
**MHD GENERATORS/PLASMA MACROINSTABILITIES**
High magnetic field MHD generator program. Quarterly report, January-March 1977, 3:21765 (FE-2341-2)
**MHD GENERATORS/PULSATIONS**
Dependence of current density and intensity of electric field on pulsation of thermodynamic parameters of plasma in a MHD generator, 3:21756
**MHD GENERATORS/SUPERCONDUCTING MAGNETS**
Superconducting magnetohydrodynamics magnet development program: Phase I. Quarterly technical progress report No. 3 (Revision A), November 1, 1976-January 31, 1977, 3:21759 (FE-2295-1)
**MHD GENERATORS/WASTE HEAT UTILIZATION**
Development program for MHD power generation: coal devolatilization. Final report, Volume VI, July 1, 1975-September 30, 1976 (Exhaust gas from MHD generator used to pyrolyze coal for production of clean fuel gas of CO and H2), 3:20855 (FE-2015-20)
**MHD POWER PLANTS/TECHNOLOGY ASSESSMENT**
MHD power generation: a technology of future, 3:21751
**MICE/BIOLOGICAL RADIATION EFFECTS**
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr-77-67)
**MICE/GENETIC MAPPING**
Improved mutagen-testing systems in mice. Progress report, 1 June 1976-31 August 1977, 3:22238 (COO-3267-15)
**MICE/GERM CELLS**
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr-77-67)
**MICE/MUTATIONS**
Improved mutagen-testing systems in mice. Progress report, 1 June 1976-31 August 1977, 3:22238 (COO-3267-15)
**MICROCOCCUS/BIOLOGICAL RADIATION EFFECTS**
Basic aspects of radiation action on microorganisms. Final report for the period ending October 31, 1977 (Radioresistance of micrococcus luteus), 3:22252 (COO-2362-27)
**MICROWAVE EQUIPMENT/COMPARATIVE EVALUATIONS**
Radio frequency drying of papers and textiles, 3:21836
**MIGMA DEVICES/DIAGNOSTIC TECHNIQUES**
Advanced fuel fusion experimentation with migmacells II and III orbit diagnostics and lifetime measurements, 3:22437
**MIGMA DEVICES/DISTRIBUTION FUNCTIONS**
Tailoring electron velocity distributions in phase space (morphodynamics), 3:22446
**MIGMA DEVICES/ELECTRON DENSITY**
Tailoring electron velocity distributions in phase space (morphodynamics), 3:22446
**MIGMA DEVICES/ION DENSITY**
Methods of 'tailoring' ion distributions in phase space ('morphodynamics'), 3:22445
**MIGMA DEVICES/RESEARCH PROGRAMS**
1976 status of the migma program of controlled fusion, 3:22548
**MILK/RADIOACTIVITY**
Radiostrontium in milk and tap water (New York City), 3:22206 (EML-334(App.))
**MILKY WAY/GAMMA RADIATION**
X-ray and gamma-ray line production by nonthermal ions, 3:22297 (N-77-27061)
**MILL TAILINGS/ENVIRONMENTAL EFFECTS**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT-20)
**MILL TAILINGS/HEALTH HAZARDS**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
**MILL TAILINGS/RADIOACTIVE WASTES**
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT-20)
**MILL TAILINGS/RADIOACTIVITY**
Estimation of $^{222}$Rn daughter doses from large-area sources, 3:22195
**MINERAL INDUSTRY**
*See also CHEMICAL INDUSTRY*
*COAL INDUSTRY*
*METAL INDUSTRY*
*OIL SHALE INDUSTRY*
*PETROLEUM INDUSTRY*
**MINERAL INDUSTRY/GLOBAL ASPECTS**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERAL INDUSTRY/MINERAL RESOURCES**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERAL INDUSTRY/WASTE PRODUCT UTILIZATION**
Positive uses of mill tailings, 3:21843
**MINERAL RESOURCES/EXPLOITATION**
Bureau of Mines research 1976: a summary of significant results in mining, metallurgy, and mineral economics, 3:21697
**MINERAL RESOURCES/EXPLORATION**
Mineral exploration and mining in Brasil--1977, 3:20915
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERAL RESOURCES/MINING**
Mineral exploration and mining in Brasil--1977, 3:20915
**MINERAL RESOURCES/PROCESSING**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERAL RESOURCES/PROGRAMMING**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERAL RESOURCES/STATISTICS**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERALS**
*See also ANHYDRITE*
*BARITE*
*PYROXENES*
*TALC*
**MINERALS/CATALYTIC EFFECTS**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**MINERALS/EVAPORATION**
Investigation of the behavior of the mineral matter of acid composition in high temperature combustion of coal, 3:20930
**MINERALS/EXPLORATION**
Nuclear techniques in exploration, extraction and processing of mineral resources. Report on the international symposium held in Vienna from 7 to 10 March 1977, 3:20942
**MINERALS/INFORMATION RETRIEVAL**
Coal minerals bibliography. Quarterly report No. 1, June 15-September 15, 1977, 3:20892 (FE/2692-1)
**MINERALS/PHASE TRANSFORMATIONS**
Investigation of the behavior of the mineral matter of acid composition in high temperature combustion of coal, 3:20930
**MINERALS/PLANNING**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERALS/PRECIPITATION**
Development of geothermal energy: some problems, 3:21447
**MINERALS/PROGRAMMING**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINERS/ALPHA DOSIMETRY**
Radon/radon-daughter measurement methods and instrumentation (Radiation monitoring of uranium mines and mills), 3:22164 (HASL-325)
**MINERS/CHRONIC IRRADIATION**
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**MINERS/RESPIRATORY SYSTEM DISEASES**
Respiratory disease mortality among uranium miners as related to height, radiation, smoking, and latent period, 3:21209 (HRP-0006691)

**MINES**
*See also COAL MINES*
*URANIUM MINES*
**MINES/RADIATION MONITORING**
Radon levels and ventilation effects in underground enclosures (Radioactivity from $^{222}Rn$ in air in Workman Mine and Carlsbad Caverns), 3:22184 (HASL-325)
**MINING**
*See also AUGER MINING*
*COAL MINING*
*SURFACE MINING*
*UNDERGROUND MINING*
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**MINING/LAND RECLAMATION**
Radon and radon daughter measurements and methods utilized by EPA's Eastern Environmental Radiation Facility (Radioactivity of air in buildings constructed on land reclaimed from phosphate mining), 3:22189 (HASL-325)
**MINING/RESEARCH PROGRAMS**
Bureau of Mines research 1976: a summary of significant results in mining, metallurgy, and mineral economics, 3:21697
**MIRRORS (MAGNETIC)**
*See MAGNETIC MIRRORS*
**MISCIBLE FLOODING**
*See MISCIBLE-PHASE DISPLACEMENT*
**MISCIBLE-PHASE DISPLACEMENT/CARBON DIOXIDE**
Supply of carbon dioxide for enhanced oil recovery. Final report, October 15, 1976-September 1, 1977, 3:20953 (FE-2515-10)
**MISSOURI/STATIONARY POLLUTANT SOURCES**
Regional air pollution study. point source emission inventory. Final report, 3:22146 (PB-269567)
**MIST EXTRACTORS/PERFORMANCE TESTING**
TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January-September 1976, 3:21525 (PB-269850)
**MIXED OXIDE FUEL FABRICATION PLANTS/NUCLEAR MATERIALS MANAGEMENT**
Controllable unit approach to material control, 3:21232
**MOBIL M-GASOLINE PROCESS**
*See also GASOLINE*
*SYNTHETIC FUELS*
**MOBIL M-GASOLINE PROCESS/PROCESS DEVELOPMENT UNITS**
Development studies on selected conversion of synthesis gas from coal to high octane gasoline. Quarterly report, October-December 1976, 3:21257 (FE-2276-6)
**MOBILE HOMES/SOLAR AIR CONDITIONING**
Kuwait solar heated and cooled home, 3:21344
**MOBILE HOMES/SOLAR HEATING SYSTEMS**
Kuwait solar heated and cooled home, 3:21344
**MOBILE HOMES/SOLAR WATER HEATERS**
Kuwait solar heated and cooled home, 3:21344
**MODELS (PLASMA)**
*See PLASMA SIMULATION*
**MOISTURE GAGES/DESIGN**
Continuous water monitor for oil-shale retort effluent, 3:21108 (UCID-17682)
**MOLDS**
*See FUNGI*
**MOLECULAR FLUORESCENCE SPECTROSCOPY**
*See FLUORESCENCE SPECTROSCOPY*
**MOLECULAR ORBITAL MODEL**
*See MOLECULES*
**MOLECULAR SIEVES/SORPTIVE PROPERTIES**
Molecular sieve dehydration and treating in expander plants: update, 3:21069 (CONF-7603113-)
**MOLECULES/PHOTOIONIZATION**
Angular distributions of photoelectrons and non-thermal photoions from atoms and molecules (Review), 3:22314 (CONF-770935-4)
**MOLLUSCS/CONTAMINATION**
Evaluation of some methods of analysis for petroleum hydrocarbons in marine organisms, 3:21053
**MOLTEN SALT REACTORS/REACTOR MATERIALS**
Status of materials development for molten salt reactors, 3:21587 (ORNL/TM-5920)
**MOLYBDENUM/COMPRESSIBILITY**
Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**MOLYBDENUM/SELF-DIFFUSION**
Anomalous diffusion in bcc metals of the 5th and 6th groups (Mo, Nb, Ta, W), 3:21891
**MOLYBDENUM ALLOYS**
*See also STAINLESS STEEL-316*
**MOLYBDENUM ALLOYS/DEPOSITION**
Wear resistant coatings for titanium alloys. Final report 15 March 1976-15 March 1977 (Cr-Mo coating on Ti-8Al-1V-1Mo substrate), 3:21872 (AD-A-042443)
**MOLYBDENUM ALLOYS/MECHANICAL PROPERTIES**
Metallurgical evolution of heavy forgings in low alloys steels for nuclear vessels (PWR; Ni-Cr-Mo steel SA 508 C 13), 3:21564
**MOLYBDENUM ALLOYS/PROTECTIVE COATINGS**
Wear resistant coatings for titanium alloys. Final report 15 March 1976-15 March 1977 (Cr-Mo coating on Ti-8Al-1V-1Mo substrate), 3:21872 (AD-A-042443)
**MOLYBDENUM COMPOUNDS/EMISSION SPECTROSCOPY**
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T-741)
**MOLYBDENUM HYDRIDES/CRYSTAL STRUCTURE**
High-precision neutron diffraction investigation of the prototype biscyclopentadienyl transition metal hydride (eta$^5$-$C_5H_5)_2MoH_2$ and resolution of the structure in terms of modern bonding theory, 3:21951
**MOLYBDENUM OXIDES/CATALYTIC EFFECTS**
Catalytic activities and selectivities of $MoO_3$-$NiSO_4$ supported on various oxides for hydrocracking of solvent refined lignite. Novel low surface area active catalysts, 3:20881
Raman spectra of supported molybdena catalysts. II. Sulfided, used, and regenerated catalysts, 3:20846
**MOLYBDENUM OXIDES/RAMAN SPECTRA**
Raman spectra of supported molybdena catalysts. II. Sulfided, used, and regenerated catalysts, 3:20846
**MONITORS (FAILED ELEMENTS)**
*See FAILED ELEMENT MONITORS*
**MONITORS (REACTOR)**
*See REACTOR CONTROL SYSTEMS*
**MONOCHROMATORS/DESIGN**
Multilayer neutron monochromators, 3:22387
**MORTALITY/DOSE-RESPONSE RELATIONSHIPS**
Estimate of early mortality and morbidity following acute inhalation of plutonium, 3:22255
**MULTI-ELEMENT ANALYSIS/RESEARCH PROGRAMS**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**MUNICH RESEARCH REACTOR**
*See FRM REACTOR*
**MUNICIPAL WASTES**
*See also REFUSE DERIVED FUELS*
**MUNICIPAL WASTES/COMBUSTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
**MUNICIPAL WASTES/GASIFICATION**
Rotary kiln gasification of biomass and municipal wastes, 3:21303 (CONF-770235-)
**MUNICIPAL WASTES/RECYCLING**
No tipping: service included in waste burning plant, 3:22083
**MUNICIPAL WASTES/WASTE PROCESSING**
No tipping: service included in waste burning plant, 3:22083
Solar powered anaerobic wastewater treatment plant, 3:21361
**MUON NEUTRINOS/MASS**
Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions, 3:22332 (LA-tr-77-76)
**MUON PAIRS/PHOTOPRODUCTION**
Weak neutral currents and photoproduction of lepton pairs, 3:22343
**MUONIC ATOMS/X-RAY SPECTRA**
Circular polarization of muonic x rays and origin of strange $\mu^-$ depolarization in Pd metal, 3:22318
**MUON-NUCLEON INTERACTIONS/DEEP INELASTIC SCATTERING**
Composite models of hadrons and large transverse processes, 3:22340
**MUONS PLUS/DIFFUSION**
Diffusion of light particles in metals, 3:22392
**MUONS PLUS/LEPTONIC DECAY**
Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions, 3:22332 (LA-tr-77-76)
**MUONS PLUS/SPIN ORIENTATION**
Polarization of prompt muons produced at large transverse momenta (2815 GeV), 3:22331
**MUSCLES/QUANTITATIVE CHEMICAL ANALYSIS**
Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis (Environmental pollution during fossil fuel combustion), 3:22276 (EML-334)
**MUSSELS**
*See MOLLUSCS*
**MUTAGENS/BIOLOGICAL EFFECTS**
Improved mutagen-testing systems in mice. Progress report, 1 June 1976-31 August 1977, 3:22238 (COO-3267-15)
Radiation cytogentics of the yellow-fever mosquito Aedes aegypti and the plant genus Collinsia. Final report, April 1967-September 1977, 3:22264 (COO-38-1838)

**MUTATIONS/RADIOINDUCTION**
Cancer induction by alpha emitting warm particles, 3:22254
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr-77-67)
**MYOCARDIAL INFARCTION/EPIDEMIOLOGY**
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22246
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247
**MYOCARDIAL INFARCTION/RISK ASSESSMENT**
Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California, 3:22247

## N

**NAPHTHA/CRACKING**
Simulation of product distributions from pyrolysis of normal and branched alkane mixtures over a wide range of conversions, 3:20989
**NAPHTHALENE/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**NAPHTHALENE/LIQUID COLUMN CHROMATOGRAPHY**
Separation of hydroaromatics and polycyclic aromatic hydrocarbons and determination of tetralin and naphthalene in coal-derived solvents, 3:20893
**NAPHTHALENE/RECOVERY**
Processing of coke furnace gas. Separation of naphthalene, 3:20886
**NATIONAL ENERGY PLAN/AGRICULTURE**
Energy policy and research in agriculture, 3:21724
**NATURAL GAS**
*See also LIQUEFIED NATURAL GAS*
**NATURAL GAS/AVAILABILITY**
Impact of natural gas shortage on major industrial fuel-burning installations. Volume I. Text, 3:21813 (PB-269365)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume II. Schedules (data and tables), 3:21814 (PB-269366)
Impact of natural gas shortage on major industrial fuel-burning installations. Volume III. Appendix: summary and analysis of fuel-burning characteristics of MFBIS, 3:21815 (PB-269367)
**NATURAL GAS/CALORIFIC VALUE**
Heating value and specific gravity measurement of natural gas for custody transfer using a computer operated process chromatography system, 3:21091 (CONF-770375-)
**NATURAL GAS/CHEMICAL COMPOSITION**
Experimental equilibrium ratios of a Devonian crude-natural gas system, 3:21039 (CONF-770375-)
**NATURAL GAS/CONTRACTS**
Economic analysis of Alaskan royalty gas contracts. A report to State of Alaska: the legislature, 3:21736 (PB-269528)
**NATURAL GAS/COOLING**
Use of pulsation-type cooling plants for low-temperature treatment of natural gas, 3:21082
**NATURAL GAS/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**NATURAL GAS/DEHYDRATION**
Glycol dehydration of natural gas containing $H_2S$ and $CO_2$, 3:21072 (CONF-7603113-)
Glycol dehydrator design manual, 3:21077 (CONF-7603113-)
Molecular sieve dehydration and treating in expander plants: update, 3:21069 (CONF-7603113-)
**NATURAL GAS/DENSITY**
Heating value and specific gravity measurement of natural gas for custody transfer using a computer operated process chromatography system, 3:21091 (CONF-770375-)
**NATURAL GAS/DESULFURIZATION**
Selective hydrogen sulfide removal, 3:21075 (CONF-7603113-)
Sweetening of light hydrocarbon liquids, 3:21073 (CONF-7603113-)
**NATURAL GAS/ECONOMICS**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**NATURAL GAS/ENERGY SUPPLIES**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
**NATURAL GAS/MECHANICAL PROPERTIES**
Evaluation of the information content of oil well products using the data about their structural and mechanical properties, 3:21046
**NATURAL GAS/MEETINGS**
Proceedings of the fifty-sixth annual convention of the Gas Processors Association, 3:21060 (CONF-770375-)
Proceedings of the gas conditioning conference, 3:21067 (CONF-7603113-)
**NATURAL GAS/PHYSICAL PROPERTIES**
Evaluation of the information content of oil well products using the data about their structural and mechanical properties, 3:21046
**NATURAL GAS/PURIFICATION**
Fundamentals of gas treating, 3:21071 (CONF-7603113-)
Importance of feed gas conditioning, 3:21065 (CONF-770375-)
Intensification of the operation of vertical gravity-type separators, 3:21080
**NATURAL GAS/QUALITY CONTROL**
Gas quality monitoring, 3:21070 (CONF-7603113-)
Process and equipment employed in the vaporisation and conditioning units of the Nievenheim LPG plant, 3:21078
**NATURAL GAS/SEPARATION PROCESSES**
Oil and gas separation on inclined shelves, 3:20969
**NATURAL GAS/THERMODYNAMIC PROPERTIES**
Perturbed-hard-chain theory for correlation of thermodynamic properties, 3:21040 (CONF-770375-)
**NATURAL GAS/TRANSPORT**
Statistical method of locating gas leaks along a gas pipeline route, 3:21095
**NATURAL GAS/UNDERGROUND STORAGE**
Hydrodynamic investigation of gas volume dynamics in a stratum of constant thickness, 3:21099
Offshore terminal with underground storage at sea, 3:21056
Underground storage of oil and gas, 3:21055
**NATURAL GAS DEPOSITS**
*See also GAS CONDENSATE FIELDS*
**NATURAL GAS DEPOSITS/EXPLOITATION**
100,000 quads of natural gas, 3:21061 (HI-2451/3-P)
**NATURAL GAS DEPOSITS/EXPLORATION**
100,000 quads of natural gas, 3:21061 (HI-2451/3-P)
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
Developments in the Irish offshore industry, 3:20961
Investigations into the carbonaceous reservoirs of the Paleozoic deposit of the South East Dnieper-Donetsk hollow, 3:20945
Nuclear techniques in exploration, extraction and processing of mineral resources. Report on the international symposium held in Vienna from 7 to 10 March 1977, 3:20942
Period of formation of rupture faults in the kyurovdag area section, 3:20943
Petroleum and natural gas exploration in the Federal Republic of Germany in 1976. On the basis of data and drilling results of petroleum companies with activities in the Federal Republic of Germany, 3:20939
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G-77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G-77/357)
**NATURAL GAS DEPOSITS/GEOLOGICAL SURVEYS**
Caroline carbon dioxide field and associated carbon dioxide occurrences, gambier embayment, south australia, 3:21063
**NATURAL GAS DEPOSITS/PROSPECTING**
Influence of hydrate formation on the information content of indicators of oil-bearing and gas-bearing potential, 3:20941
Results and effectiveness of gas prospecting operations in the main areas of the western Precaucasus, 3:21062
**NATURAL GAS DEPOSITS/REMOTE SENSING**
U.S. Geological Survey project BIRDDOG (basic investigation of remotely detectable deposits of oil and gas), 3:20948
**NATURAL GAS DISTRIBUTION SYSTEMS**
*See also PIPELINES*
**NATURAL GAS DISTRIBUTION SYSTEMS/EXPANSION JOINTS**
Investigations of displacements of open sections of pipelines, 3:21096
**NATURAL GAS DISTRIBUTION SYSTEMS/LEAK TESTING**
Statistical method of locating gas leaks along a gas pipeline route, 3:21095
**NATURAL GAS DISTRIBUTION SYSTEMS/RESEARCH PROGRAMS**
Distribution research, 3:21093
**NATURAL GAS FIELDS/LEASING**
Outer Continental Shelf Sale 40: inadequate data used to select and evaluate lands to lease. Department of the Interior. Report to the Congress, 3:21729 (PB-269865)
**NATURAL GAS GATHERING SYSTEMS**
*See NATURAL GAS DISTRIBUTION SYSTEMS*
**NATURAL GAS INDUSTRY/ECONOMIC DEVELOPMENT**
Technical and economic development trends in the gas supply industry, 3:21090
Tendencies of technical and economic development in the public gas supply industry (German Federal Republic), 3:21089

**NATURAL GAS INDUSTRY/ECONOMICS**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
**NATURAL GAS INDUSTRY/EQUIPMENT**
Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976-August 1977, 3:20840 (FE-2479-1)
**NATURAL GAS INDUSTRY/RELIABILITY**
Technical and economic development trends in the gas supply industry, 3:21090
**NATURAL GAS LIQUIDS**
*See also LIQUEFIED PETROLEUM GASES*
**NATURAL GAS LIQUIDS/DESULFURIZATION**
Desulfurization of wide cut of light hydrocarbons from Orenburg gas condensate, 3:21086
Iron sponge treating of natural gas liquids, 3:21074 (CONF-7603113-)
Sweetening of light hydrocarbon liquids, 3:21073 (CONF-7603113-)
**NATURAL GAS LIQUIDS/PRODUCTION**
Liquid hydrocarbon production in the United States, 1946-75 and 1980 projected, highlighting enhanced recovery. Information circular, 3:20958 (PB-269951)
**NATURAL GAS PROCESSING PLANTS/CORROSION PROTECTION**
Corrosion control in gas processing plants which remove both $CO_2$ and $H_2S$, 3:21068 (CONF-7603113-)
**NATURAL GAS PROCESSING PLANTS/DESIGN**
Design of automatic condensate extractors, 3:21084
Evolution in design, 3:21066 (CONF-770375-)
**NATURAL GAS PROCESSING PLANTS/EQUIPMENT**
Design of automatic condensate extractors, 3:21084
**NATURAL GAS PROCESSING PLANTS/FLOWSHEETS**
Evaluation of thermophysical property correlations, 3:21064 (CONF-770375-)
**NATURAL GAS PROCESSING PLANTS/HEAT TRANSFER**
Use of pulsation-type cooling plants for low-temperature treatment of natural gas, 3:21082
**NATURAL GAS PROCESSING PLANTS/MECHANICAL VIBRATIONS**
Principle of operation and method of calculating depulsators, 3:21081
**NATURAL GAS PROCESSING PLANTS/OPERATION**
Desulfurization of wide cut of light hydrocarbons from Orenburg gas condensate, 3:21086
**NATURAL GAS PROCESSING PLANTS/PERFORMANCE TESTING**
Intensification of the operation of vertical gravity-type separators, 3:21080
**NATURAL GAS PROCESSING PLANTS/SAFETY**
Relationship of new Texas sour gas rules to gas conditioning operations, 3:21088 (CONF-7603113-)
**NATURAL GAS PROCESSING PLANTS/SAFETY ENGINEERING**
Philosophies of safety in sour gas processing, 3:21087 (CONF-7603113-)
**NATURAL GAS PROCESSING PLANTS/START-UP**
Importance of feed gas conditioning, 3:21065 (CONF-770375-)
**NATURAL GAS PROCESSING PLANTS/VALVES**
Operating experience with amine absorber level control valves, 3:21076 (CONF-7603113-)
**NATURAL GAS WELLS/GAS GENERATORS**
Ignition process for downhole gas generator (Patent), 3:20960
**NATURAL GAS WELLS/MAPS**
Wells drilled for oil and gas in Nevada through 1976, 3:20982
**NATURAL GAS WELLS/TEMPERATURE MEASUREMENT**
Investigation of the quality of gas well cementing by detailed thermometry methods, 3:21083
**NATURAL GAS WELLS/WELL COMPLETION**
Investigation of the quality of gas well cementing by detailed thermometry methods, 3:21083
**NATURAL RADIOACTIVITY**
*(For unspecified naturally occuring radioisotopes only; not for BACKGROUND RADIATION.)*
**NATURAL RADIOACTIVITY/RADIATION MONITORING**
Variation of radon and radon daughter concentrations with height above ground, 3:22177 (HASL-325)
**NEODYMIUM CHLORIDES/EXCITED STATES**
Deactivation on the $Nd^{3+}$,$^4F$/sub 3/2/ level in neodymium chloride-aluminum chloride vapor complexes, 3:21965
**NEODYMIUM CHLORIDES/FLUORESCENCE**
Deactivation on the $Nd^{3+}$,$^4F$/sub 3/2/ level in neodymium chloride-aluminum chloride vapor complexes, 3:21965
**NEODYMIUM LASERS/ALIGNMENT**
Automatic alignment system for the twenty beam shiva fusion laser, 3:22652 (UCRL-80249)
**NEODYMIUM LASERS/AMPLIFIERS**
Neodymium-glass disk amplifier, 3:22049
**NEODYMIUM LASERS/DAMAGE**
Damage history of Argus, a 4TW Nd-glass system, 3:22026 (UCRL-80419)
**NEODYMIUM LASERS/GAIN**
Neodymium-glass disk amplifier, 3:22049
**NEODYMIUM LASERS/PERFORMANCE**
Yttrium aluminum garnet driving oscillator and formation of the spectral radiation composition of a powerful laser, 3:22066 (ORNL-tr-4534)
**NEODYMIUM LASERS/POWER SUPPLIES**
Power source of pumping system of a Q-switched solid-state laser, based on a multisection inductive storage device, 3:22655 (UCRL-Trans-11308)
**NEON/ATOM-MOLECULE COLLISIONS**
Quasiclassical trajectory study of the energy transfer in $CO_2$-rare gas systems, 3:22319
**NEON/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**NEOPLASMS**
*See also CARCINOMAS*
*LEUKEMIA*
**NEOPLASMS/BIOLOGICAL RADIATION EFFECTS**
Analysis of animal experiments of radiation dependent tumor regression in relation to different parameters, 3:22261 (LA-tr-77-73A)
**NEOPLASMS/CELL PROLIFERATION**
Characterization of malignant ovarian tumors by impulse cytophotometry, 3:22236 (LA-tr-77-94)
**NEOPLASMS/CYTOLOGY**
Characterization of malignant ovarian tumors by impulse cytophotometry, 3:22236 (LA-tr-77-94)
Impulse cytophotometric studies on tumor material, 3:22234 (LA-tr-77-88)
**NEOPLASMS/PHOTOMETRY**
Characterization of malignant ovarian tumors by impulse cytophotometry, 3:22236 (LA-tr-77-94)
Impulse cytophotometric studies on tumor material, 3:22234 (LA-tr-77-88)
**NEOPLASMS/RADIOINDUCTION**
Cancer induction by alpha emitting warm particles, 3:22254
Exposure to radon daughters and the incidence of lung cancer, 3:22256
**NEOPLASMS/RADIOTHERAPY**
Analysis of animal experiments of radiation dependent tumor regression in relation to different parameters, 3:22261 (LA-tr-77-73A)
**NEPTUNIUM/EXTRACTION CHROMATOGRAPHY**
Investigation of special resins for the extraction-chromatogaphic separation of Np and Pu from the process stream of a reprocessing plant for HTR fuel elements, 3:21158 (GERHTR-181)
**NEPTUNIUM/IONIZATION POTENTIAL**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**NEPTUNIUM/SELF-DIFFUSION**
Anomalous self-diffusion in rare earths and actinides, 3:21892
**NEPTUNIUM 227/NUCLEAR STRUCTURE**
Nuclear data sheets for A=227, 3:22377
**NEPTUNIUM COMPLEXES/STRUCTURAL CHEMICAL ANALYSIS**
Moessbauer spectra of Np(V)-Cr(III) and Np(V)-Rh(III) complexes, 3:21962
**NETWORKS (COMPUTER)**
*See COMPUTER NETWORKS*
**NEUTRAL ATOM BEAM INJECTION/ALFVEN WAVES**
Collective processes in the case of injection of rapid neutral atoms in a tokamak with noncircular cross section, 3:22416 (ERDA-tr-316)
**NEUTRAL BEAM SOURCES**
*See also ION SOURCES*
**NEUTRAL BEAM SOURCES/BEAM TRANSPORT**
New ORNL neutral beam transport system, 3:22615 (CONF-771029-147)
**NEUTRAL BEAM SOURCES/CRYOPUMPS**
Performance of 4.2 K cryopumps in neutral beam injectors, 3:22684
**NEUTRAL BEAM SOURCES/DIRECT ENERGY CONVERTERS**
Neutral beam based on positive ions with direct energy conversion, 3:22623 (UCRL-80418)
**NEUTRAL BEAM SOURCES/GAS FLOW**
Power and gas flow models for monoenergetic neutral beam injectors, 3:22616 (CONF-771029-188)
**NEUTRAL BEAM SOURCES/IMPURITIES**
Impurity studies experiment/ORMAK-upgrade neutral beam systems, 3:22626

**NEUTRAL BEAM SOURCES/ION SOURCES**
Negative hydrogen ion sources for neutral beam injectors, 3:22613 (BNL-23389)
**NEUTRAL BEAM SOURCES/PERFORMANCE**
Impurity studies experiment/ORMAK-upgrade neutral beam systems, 3:22626
Performance of a developmental 120-keV, 10-A deuterium (14-A hydrogen) neutral beam system, 3:22619 (LBL-6384)
**NEUTRAL BEAM SOURCES/SIZE**
Engineering problems of future neutral beam injectors, 3:22620 (UCRL-80384)
**NEUTRAL BEAM SOURCES/SPECIFICATIONS**
Neutral beam requirements for mirror reactors, 3:22622 (UCRL-80408)
PLT neutral particle injectors, 3:22625
**NEUTRAL BEAM SOURCES/SWITCHES**
SCR series switch and impulse crowbar at the Lawrence Berkeley Laboratory for CTR neutral beam source development, 3:22602 (LBL-6382)
**NEUTRAL BEAM SOURCES/TEST FACILITIES**
Calorimetric and optical beam diagnostics on the LBL 120-keV neutral beam test facility, 3:22618 (LBL-6383)
**NEUTRETTOS**
*See MUON NEUTRINOS*
**NEUTRINO-NUCLEON INTERACTIONS**
*See also ANTINEUTRINO-NUCLEON INTERACTIONS*
**NEUTRINO-NUCLEON INTERACTIONS/WEAK NEUTRAL CURRENTS**
Production of charmed particles in weak interactions with diagonal neutral currents, 3:22345
**NEUTRON ABSORBERS/PHYSICAL PROPERTIES**
Technology and assessment of neutron absorbing materials, 3:21884 (TRG-Report-2953(S))
**NEUTRON ABSORBERS/PHYSICAL RADIATION EFFECTS**
Technology and assessment of neutron absorbing materials, 3:21884 (TRG-Report-2953(S))
**NEUTRON BEAMS/MONOCHROMATORS**
Multilayer neutron monochromators, 3:22387
**NEUTRON CAPTURE**
*See NEUTRON BEAMS*
**NEUTRON DETECTION/ACTIVATION DETECTORS**
Activation detectors for recording pulsed fluxes of fast neutrons, 3:22121 (ORNL-tr-4529)
**NEUTRON DIFFRACTION/CORRECTIONS**
Correction factors for neutron diffraction from lamellar structures, 3:22388
**NEUTRON DIFFRACTION/DATA PROCESSING**
Estimating unit cell volumes from powder diffraction data: the triclinic case, 3:21972
**NEUTRON DOSIMETRY**
Dosimetry needs for the Magnetic Fusion Materials Program, 3:22677 (CONF-771036-6)
**NEUTRON MOISTURE METERS**
*See MOISTURE GAGES*
**NEUTRON MULTIPLIER FACILITY**
*See SUBCRITICAL ASSEMBLIES*
**NEUTRON RADIOGRAPHY/SENSITIVITY**
Contrast reduction factor for object contrast assessment in neutron radiography, 3:22073
**NEUTRON REACTIONS/CAPTURE**
High resolution neutron transmission and capture for $^{91}$Zr, 3:22366
**NEUTRON REACTIONS/FAST FISSION**
Delayed neutron spectra from $^{232}$Th, $^{233}$U, $^{235}$U, and $^{239}$Pu, 3:22379 (RLO/2225/T3-6)
**NEUTRON REACTIONS/THERMAL FISSION**
Review of microscopic integral cross section data in fundamental reactor dosimetry benchmark neutron fields, 3:22378 (HEDL-SA-1148(Rev.1))
**NEUTRON REACTIONS/TRANSMISSION**
High resolution neutron transmission and capture for $^{91}$Zr, 3:22366
Neutron resonance parameters of $^{90}$Zr below 300 keV, 3:22365
**NEUTRON SOURCE FACILITIES/RESEARCH PROGRAMS**
Intense neutron source facility. Progress report, July 1-September 30, 1977, 3:22096 (LA-7023-PR)
**NEUTRON SOURCES**
*(Excludes reactors even when used as neutron sources.)*
**NEUTRON SOURCES/PERFORMANCE**
Feasibility of beam driven semi-catalyzed deuterium fusion neutron sources for hybrid reactor applications, 3:22683 (PPPL-1399)
**NEUTRON SOURCES/RADIATION PROTECTION**
Radiation protection design guidelines for 0.1 to 100 MeV particle accelerator facilities, 3:22097 (NCRP-51)
**NEUTRON SPECTRA/SPATIAL DISTRIBUTION**
Measurement and analysis of neutron spectrum in spherical pile of thoria, 3:21147
**NEUTRON TRANSPORT THEORY/COMPUTER CODES**
User's manual for the CDC-6600 version of AMPX, 3:22385 (SAND-77-1148)
**NEUTRONS**
*See also FAST NEUTRONS*
**NEUTRONS/ELECTRIC DIPOLE MOMENTS**
Proposed neutron bottle for the Argonne pulsed neutron source and its application in the search for the neutron electric dipole moment, 3:22119 (ORO-2504-267)
**NEUTRONS/ELECTROMAGNETIC FORM FACTORS**
Why the neutron isn't all neutral, 3:22329
**NEUTRONS/PARTICLE RADII**
Why the neutron isn't all neutral, 3:22329
**NEVADA/NATURAL GAS WELLS**
Wells drilled for oil and gas in Nevada through 1976, 3:20982
**NEVADA/OIL WELLS**
Wells drilled for oil and gas in Nevada through 1976, 3:20982
**NEVADA/PLANTS**
Endangered and threatened plant species of the Nevada Test Site, Ash Meadows, and central-southern Nevada, 3:22198 (COO-2307-13)
**NEVADA/URANIUM DEPOSITS**
Preliminary study of the uranium favorability of granitic and contact-metamorphic rocks of the Owens Valley area, Inyo and Mono Counties, California, and Esmeralda and Mineral Counties, Nevada, 3:21120 (GJBX-3(78))
**NEW JERSEY/WATER POLLUTION CONTROL**
Determination of an oil effluent guideline for industrial discharges in the state of New Jersey: is 1 ppM realistic and obtainable, 3:21026
**NEW MEXICO/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**NEW MEXICO/RADIOACTIVE WASTE STORAGE**
Archaeological reconnaissance of a proposed site for the Waste Isolation Plant (WIPP), 3:21167 (SAND-77-7024)
**NEW MEXICO/URANIUM DEPOSITS**
Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX-78(77))
Preliminary study of favorability for uranium of the Sangre de Cristo Formation in the Las Vegas basin, northeastern New Mexico, 3:21123 (GJBX-82(77))
**NEW YORK**
*See also NEW YORK CITY*
**NEW YORK/ENERGY ANALYSIS**
Energy information and analytic system for New York State, 3:21679 (BNL-22677)
**NEW YORK/ENERGY POLICY**
Conservation of energy through state action, 3:21783
**NEW YORK CITY/FALLOUT**
EML fallout program data, 3:22155 (EML-334)
**NEW YORK CITY/HUMAN POPULATIONS**
Radiostrontium in milk and tap water (New York City), 3:22206 (EML-334(App.))
**NICKEL/PHYSICAL RADIATION EFFECTS**
Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA-1252)
Temperature dependence of helium blistering in nickel monocrystals, 3:21896
**NICKEL/SORPTIVE PROPERTIES**
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL-6906)
**NICKEL/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**NICKEL 58/CHARGE DISTRIBUTION**
Elastic scattering of 0.8-GeV protons from $^{12}$C, $^{58}$Ni, and $^{208}$Pb, 3:22354
**NICKEL 58 TARGET/PROTON REACTIONS**
Elastic scattering of 0.8-GeV protons from $^{12}$C, $^{58}$Ni, and $^{208}$Pb, 3:22354
**NICKEL ALLOYS**
*See also NICKEL STEELS*
*NICKEL-CHROMIUM STEELS*
**NICKEL ALLOYS/SORPTIVE PROPERTIES**
Low-temperature absorption equilibrium and chemisorption in the $LaNi_5$(activated)/$H_2$ system, 3:21254
**NICKEL COMPOUNDS/EXTRACTION**
Phase state of ash remainders of residual fuel oil, 3:21844
**NICKEL OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**NICKEL STEELS**
*(Steels containing only nickel as alloying element.)*

**NICKEL STEELS/ABRASION**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**NICKEL STEELS/WEAR**
Microstructural effects in abrasive wear. Quarter progress report, June 16-September 15, 1977, 3:21878 (COO-4246-2)
**NICKEL SULFATES/CATALYTIC EFFECTS**
Catalytic activities and selectivities of $MoO_3$-$NiSO_4$ supported on various oxides for hydrocracking of solvent refined lignite. Novel low surface area active catalysts, 3:20881
**NICKEL-CADMIUM BATTERIES/RESEARCH PROGRAMS**
Towards long-lived satellites, 3:21674
**NICKEL-CHROMIUM STEELS**
*(Steels containing Ni and Cr; the Cr content is usually 0.5 to 2.0%, the Ni content is higher.)*
**NICKEL-CHROMIUM STEELS/MECHANICAL PROPERTIES**
Metallurgical evolution of heavy forgings in low alloys steels for nuclear vessels (PWR; Ni-Cr-Mo steel SA 508 C 13), 3:21564
**NICKEL-HYDROGEN BATTERIES/RESEARCH PROGRAMS**
Towards long-lived satellites, 3:21674
**NIOBIUM/CASTING**
Present position of electron beam melting and casting technology, 3:21837
**NIOBIUM/COMPRESSIBILITY**
Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**NIOBIUM/ELECTRON BEAM MELTING**
Present position of electron beam melting and casting technology, 3:21837
**NIOBIUM/PERMEABILITY**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**NIOBIUM/SELF-DIFFUSION**
Anomalous diffusion in bcc metals of the 5th and 6th groups (Mo, Nb, Ta, W), 3:21891
**NIOBIUM ALLOYS**
*See also NIOBIUM BASE ALLOYS*
**NIOBIUM ALLOYS/CRITICAL CURRENT**
Vortex-pinning forces in superconducting niobium-zirconium alloys with low j/sub c/, 3:21889
**NIOBIUM ALLOYS/IRRADIATION PROCEDURES**
DT fusion neutron irradiation of LLL Nb-1Zr tensile specimens at 600°C, 3:21895 (UCID-17666)
**NIOBIUM ALLOYS/MAGNETIC FLUX**
Vortex-pinning forces in superconducting niobium-zirconium alloys with low j/sub c/, 3:21889
**NIOBIUM ALLOYS/PERMEABILITY**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**NIOBIUM ALLOYS/PHYSICAL RADIATION EFFECTS**
DT fusion neutron irradiation of LLL Nb-1Zr tensile specimens at 600°C, 3:21895 (UCID-17666)
**NIOBIUM BASE ALLOYS/CRITICAL CURRENT**
Critical-current densities of bronze-processed $Nb_3$(Sn/sub 1-x/Ga/sub x/) wires up to 23.5 T, 3:21887
**NIOBIUM BASE ALLOYS/SUPERCONDUCTIVITY**
Peak effect in type II superconductors, 3:21875
**NITRATES/REMOVAL**
Continuous fixed-film denitrification of high-strength industrial nitrate wastes, 3:21845
**NITRIC OXIDE/ELECTRON-MOLECULE COLLISIONS**
Doublet→quartet transitions in nitric oxide as detected by electron-impact spectroscopy, 3:22320
**NITRIC OXIDE/ENERGY-LEVEL TRANSITIONS**
Doublet→quartet transitions in nitric oxide as detected by electron-impact spectroscopy, 3:22320
**NITRIC OXIDE/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**NITROBENZENE/PHOTOMETRY**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**NITROGEN/ABUNDANCE**
Distribution of nitrogen in the refining products of some types of petroleum of the subcarpathian region, 3:21043
**NITROGEN/ACTIVATION ANALYSIS**
Fast-neutron activation analysis in coal research, 3:21921
**NITROGEN/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**NITROGEN/REMOVAL**
Catalysts for upgrading coal-derived liquids. Quarterly report, June 9-September 8, 1977, 3:20878 (FE-2011-9)
**NITROGEN 13/RADIOCHEMISTRY**
Cyclotron production of $^{13}N$ compounds for environmental and biological research, 3:21997
**NITROGEN 14 REACTIONS/FUSION REACTIONS**
Measurements of the fusion of $^{12}C + {}^{14}N$ and the liquid-drop limit for $^{26}Al$, 3:22356
**NITROGEN COMPOUNDS/CHEMICAL REACTION YIELD**
Nature and formation of nitrogenous air pollutant emissions from combustion systems, 3:21999 (LBL-6850)
**NITROGEN COMPOUNDS/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**NITROGEN COMPOUNDS/FLUORESCENCE**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**NITROGEN DIOXIDE/GAS ANALYSIS**
$NO_2$ levels in diesel exhaust, 3:22090 (BERC/TPR-78/1)
**NITROGEN DIOXIDE/ION-MOLECULE COLLISIONS**
Uranium atoms and ions in the gas phase. Progress report, March 1, 1977-February 28, 1978, 3:21141 (COO/4295-1)
**NITROGEN DIOXIDE/REMOVAL**
Process for separation of nitrogen oxides from waste gas (Patent), 3:20907
**NITROGEN OXIDES**
*See also NITRIC OXIDE*
*NITROGEN DIOXIDE*
*NITROUS OXIDE*
**NITROGEN OXIDES/AIR POLLUTION ABATEMENT**
Experimental study on the emissions of a model gas turbine combustor, 3:21866
Nitrogen oxide formation in the fuel spray of a vortex burner burning a mixture of anthracite fines and sludge, 3:21527
Simplified reactive flow model of gas turbine combustors for predicting nitric oxide emission, 3:21867
**NITROGEN OXIDES/CHEMICAL ANALYSIS**
Problem of determination of nitrogen oxides, 3:21007
**NITROGEN OXIDES/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
**NITROGEN OXIDES/PURIFICATION**
Process for the treatment of flue and waste gases (Patent), 3:20908
**NITROGEN OXIDES/REMOVAL**
Process for the treatment of flue and waste gases (Patent), 3:20908
Process for the removal of nitrogen oxides from flue gas, 3:20906
**NITROMETHANE/IGNITION**
Thermal ignition time for homogeneous explosives involving two parallel reactions, 3:22136
**NITROUS OXIDE/REMOVAL**
Process for separation of nitrogen oxides from waste gas (Patent), 3:20907
**NMR**
*See NUCLEAR MAGNETIC RESONANCE*
**NON-PROLIFERATION TREATY/GOVERNMENT POLICIES**
U.S. nonproliferation policy and the reactions of the technical community, 3:22139 (CONF-771055-1)
**NORTH CAROLINA/URANIUM DEPOSITS**
Savannah River Laboratory Hydrogeochemical and Stream Sediment Reconnaissance. Preliminary raw data release: Spartanburg 1° x 2° NTMS area, North Carolina and South Carolina. National Uranium Resource Evaluation Program, 3:21118 (DPST-77-146-2)
**NORTH DAKOTA/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**NORTH DAKOTA/COMMUNITIES**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume I, 3:21681 (HCP/M3879-1(Vol.1))
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Executive summary, 3:21682 (HCP/M3879-0003)
**NORTH SEA/NATURAL GAS**
Norway's oil and gas wealth stimulates industrial growth, 3:21735
**NORTH SEA/OIL FIELDS**
Drilling technique in the development of the North Sea's Forties Field, 3:20957
**NORTH SEA/PETROLEUM**
Norway's oil and gas wealth stimulates industrial growth, 3:21735
**NORTHERN IRELAND**
*See UNITED KINGDOM*
**NORTHWEST TERRITORIES/URANIUM DEPOSITS**
Geochemical methods applied to uranium exploration in southwest Baffin Island, 3:21131
**NORWAY/NATURAL GAS**
Norway's oil and gas wealth stimulates industrial growth, 3:21735

**NORWAY/PETROLEUM**
Norway's oil and gas wealth stimulates industrial growth, 3:21735
**NUCLEAR DATA COLLECTIONS**
Reference nuclear data for space technology, 3:22290
**NUCLEAR ENERGY**
Travels in the new world. Volume III (Nuclear energy developments, 1961-71), 3:22403 (PUB-113(Vol.3))
**NUCLEAR ENERGY/DEMAND FACTORS**
Contribution to the general discussion by delegate from France (France's positive stand for nuclear energy), 3:21704 (CONF-770971-1)
**NUCLEAR ENERGY/ENERGY SOURCE DEVELOPMENT**
Contribution to the general discussion by delegate from France (France's positive stand for nuclear energy), 3:21704 (CONF-770971-1)
**NUCLEAR ENGINEERING**
Reliability engineering, why do we need it, 3:21614
**NUCLEAR ENGINEERING/EDUCATION**
Brazilian special master's program: an experience, 3:21603
Development of a nuclear engineering computer code workshop, 3:21607
Experience with team-teaching at the University of Illinois, 3:21604
Reliability course for nuclear engineering students, 3:21605
**NUCLEAR EXPLOSIONS**
Effect of detonation depth on the action of underground explosions in rock, 3:22137 (LA-tr-77-65)
**NUCLEAR EXPLOSIONS/FALLOUT**
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**NUCLEAR FACILITIES**
*See also FEED MATERIALS PLANTS*
*FUEL FABRICATION PLANTS*
*FUEL REPROCESSING PLANTS*
**NUCLEAR FACILITIES/DECOMMISSIONING**
Cleaning up the remains of nuclear facilities--a multibillion dollar problem: Energy Research and Development Administration. Nuclear Regulatory Commission. Report to the Congress, 3:21701 (PB-269745)
**NUCLEAR FACILITIES/DECONTAMINATION**
Cleaning up the remains of nuclear facilities--a multibillion dollar problem: Energy Research and Development Administration. Nuclear Regulatory Commission. Report to the Congress, 3:21701 (PB-269745)
**NUCLEAR FACILITIES/GOVERNMENT POLICIES**
Cleaning up the remains of nuclear facilities--a multibillion dollar problem: Energy Research and Development Administration. Nuclear Regulatory Commission. Report to the Congress, 3:21701 (PB-269745)
**NUCLEAR FACILITIES/PHYSICAL PROTECTION DEVICES**
Physical protection safeguards for nuclear materials and facilities, 3:21225
**NUCLEAR FACILITIES/RADIATION MONITORING**
Environmental surveillance for nuclear facilities, 3:21202
Formerly utilized MED/AEC sites remedial action program. Radiological survey of the Middlesex Sampling Plant, Middlesex, New Jersey. Final report, 3:21208 (DOE/EV-0005-1)
**NUCLEAR FACILITIES/RADIOACTIVE EFFLUENTS**
Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**NUCLEAR FACILITIES/SAFEGUARDS**
Automated approach to nuclear facility safeguards effectiveness evaluation, 3:21231
**NUCLEAR FORCES**
New look at the nuclear force, 3:22380 (SLAC-PUB-1601)
**NUCLEAR FUELS**
*See also FUEL ELEMENTS*
*FUEL SLURRIES*
*SPENT FUELS*
**NUCLEAR FUELS/AUTORADIOGRAPHY**
Autoradiographic techniques for rapid inventory of reactor fuel, 3:21235
**NUCLEAR FUELS/INVENTORIES**
Autoradiographic techniques for rapid inventory of reactor fuel, 3:21235
**NUCLEAR FUELS/NEUTRON RADIOGRAPHY**
Resonance energy neutron radiography techniques, 3:22074
**NUCLEAR FUELS/RADIATION HAZARDS**
Relative occupational risks of plutonium and $^{233}U$ fuels, 3:22266
**NUCLEAR FUELS/TOMOGRAPHY**
Computerized axial tomography for neutron radiography of nuclear fuel, 3:22075
**NUCLEAR FUELS/TRANSPORT**
Feasibility of transporting nuclear fuel by air, 3:21163
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**NUCLEAR INDUSTRY/MATERIALS**
Nuclear safety problems and their consequences on the materials used, 3:21214
**NUCLEAR INDUSTRY/NONDESTRUCTIVE TESTING**
Course in quality assurance, nondestructive testing, and nuclear standards, 3:21608
**NUCLEAR INDUSTRY/PERSONNEL**
Training and career plan for engineers in the nuclear industry, 3:21602
**NUCLEAR INDUSTRY/PUBLIC RELATIONS**
Engineers must become more aware of public acceptance, 3:21606
**NUCLEAR INDUSTRY/QUALITY ASSURANCE**
Course in quality assurance, nondestructive testing, and nuclear standards, 3:21608
**NUCLEAR INDUSTRY/RADIATION HAZARDS**
Penchant for protectionism, 3:21217
**NUCLEAR INDUSTRY/SIMULATION**
Simulation of the nuclear power economy, 3:21703
**NUCLEAR MAGNETIC RESONANCE**
Blood flow imaging with nuclear magnetic resonance, 3:22242
**NUCLEAR MATERIALS DIVERSION/DOMESTIC SAFEGUARDS**
Insider safeguards effectiveness model (ISEM). User's guide, 3:21221 (SAND-77-0043)
**NUCLEAR MATERIALS MANAGEMENT**
Controllable unit approach to material control, 3:21232
Physical protection safeguards for nuclear materials and facilities, 3:21225
Recent developments and accomplishments in safeguards education and standards for the control of nuclear materials, 3:21223
**NUCLEAR MATERIALS MANAGEMENT/COUNTING TECHNIQUES**
Thermal-neutron coincidence counting of large plutonium samples, 3:21230
**NUCLEAR MATERIALS MANAGEMENT/DATA PROCESSING**
Extensions of Kalman recursive estimation theory to retrospective updating and interpolation with applications to instrument calibration, 3:21222 (UCRL-13733-5)
**NUCLEAR MATERIALS MANAGEMENT/SAFEGUARDS**
Decision analysis in safeguarding special nuclear material, 3:21227
**NUCLEAR MATERIALS MANAGEMENT/SECURITY**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**NUCLEAR MATERIALS POSSESSION/GOVERNMENT POLICIES**
U.S. nonproliferation policy and the reactions of the technical community, 3:22139 (CONF-771055-1)
**NUCLEAR MEDICINE**
*See also SCINTISCANNING*
**NUCLEAR MEDICINE/TECHNOLOGY ASSESSMENT**
Nuclear medicine 1977: an assessment, 3:22241
**NUCLEAR PHYSICS**
Travels in the new world. Volume III (Nuclear energy developments, 1961-71), 3:22403 (PUB-113(Vol.3))
**NUCLEAR POWER/MEETINGS**
Transactions of the American Nuclear Society 1977 winter meeting held Nov. 27-Dec 2, 1977, in San Francisco, California, 3:21554
**NUCLEAR POWER/OPTIMIZATION**
Simulation of the nuclear power economy, 3:21703
**NUCLEAR POWER/PLANNING**
Nuclear power generation, 3:21600
**NUCLEAR POWER PLANTS**
*See also SWESSAR STANDARD PLANT*
**NUCLEAR POWER PLANTS/AUXILIARY SYSTEMS**
Modeling and analysis for seismic adequacy in air handling unit enclosures, 3:21613
**NUCLEAR POWER PLANTS/AVAILABILITY**
Implementation of availability engineering in the nuclear utility industry, 3:21555
**NUCLEAR POWER PLANTS/DIESEL ENGINES**
Method of combining diesel-generator set detailed component models into a composite model, 3:21601
**NUCLEAR POWER PLANTS/ECONOMICS**
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)
**NUCLEAR POWER PLANTS/EFFICIENCY**
On the complex analysis of the reliability, safety, and economic efficiency of atomic electric power stations, 3:21597
**NUCLEAR POWER PLANTS/ENVIRONMENTAL EFFECTS**
Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs, 3:22210 (ANL/ES-61)
**NUCLEAR POWER PLANTS/LOAD MANAGEMENT**
Dispatch of nuclear power plants, 3:21598

**NUCLEAR POWER PLANTS/NET ENERGY**
Dynamical analysis of processes substituting fossil energy, 3:21599
**NUCLEAR POWER PLANTS/PERFORMANCE**
On the complex analysis of the reliability, safety, and economic efficiency of atomic electric power stations, 3:21597
**NUCLEAR POWER PLANTS/PERSONNEL**
General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants (Sweden), 3:22260 (ORNL-tr-4547)
**NUCLEAR POWER PLANTS/PLANNING**
Industry in national planning: the power industry (1985 and 20005), 3:21742 (SIND-PM-1977-3)
**NUCLEAR POWER PLANTS/POLLUTION CONTROL EQUIPMENT**
Financing nuclear power plant pollution controls, 3:21620
**NUCLEAR POWER PLANTS/RADIOACTIVE EFFLUENTS**
Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants, 3:22196
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**NUCLEAR POWER PLANTS/REACTOR ACCIDENTS**
Review of safety-related occurrences in nuclear power plants as reported in 1976, 3:21653
**NUCLEAR POWER PLANTS/REACTOR LICENSING**
NRC program for the resolution of generic issues related to nuclear power plants. (Includes plans for the resolution of "unresolved safety issues" pursuant to Section 210 of the Energy Reorganization Act of 1974, as amended), 3:21594 (NUREG-0410)
**NUCLEAR POWER PLANTS/REACTOR SAFETY**
On the complex analysis of the reliability, safety, and economic efficiency of atomic electric power stations, 3:21597
**NUCLEAR POWER PLANTS/RELIABILITY**
On the complex analysis of the reliability, safety, and economic efficiency of atomic electric power stations, 3:21597
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)
**NUCLEAR POWER PLANTS/SAFETY ENGINEERING**
General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants (Sweden), 3:22260 (ORNL-tr-4547)
**NUCLEAR POWER PLANTS/SIMULATION**
Simulation of the nuclear power economy, 3:21703
**NUCLEAR POWER PLANTS/SITE SELECTION**
State side of the siting equation: some case studies, 3:21621
Territorial and engineering requirements in nuclear stations siting, 3:21622
Water supplies and the nuclear licensing process, 3:21595 (PB-270463)
**NUCLEAR POWER PLANTS/STEAM TURBINES**
Experience of operation of saturated steam turbines of nuclear power plants, 3:21611
**NUCLEAR POWER PLANTS/THERMAL EFFLUENTS**
Thermal impact assessment of multi-power plant operations on estuaries, 3:22229
**NUCLEAR PROPERTIES/NUCLEAR DATA COLLECTIONS**
Nuclear data sheets, 3:22353
**NUCLEAR REACTION ANALYSIS**
*(Chemical analysis based on detection and analysis of prompt nuclear reaction products, e.g., gamma rays, neutrons, or charged particles.)*
Beryllium-reflected coal analytical assembly using $^{252}Cf$ neutron-capture gamma rays, 3:21924
**NUCLEAR REACTION ANALYSIS/CORRECTIONS**
Reduced variance multiplication meter for plutonium sample verification and assay applications, 3:21234
**NUCLEAR REACTIONS**
*See also ALPHA REACTIONS*
*ARGON 40 REACTIONS*
*HEAVY ION REACTIONS*
*NEUTRON REACTIONS*
*NITROGEN 14 REACTIONS*
*OXYGEN 16 REACTIONS*
*PION REACTIONS*
*PROTON REACTIONS*
*SPONTANEOUS FISSION*
*THERMONUCLEAR REACTIONS*
**NUCLEAR REACTIONS/MATRIX ELEMENTS**
Extreme values of spin-polarization analyzing powers in nuclear reactions: M-matrix conditions, 3:22383
**NUCLEAR REACTIONS/NUCLEAR DATA COLLECTIONS**
Nuclear data sheets, 3:22353
**NUCLEAR SPIN RESONANCE**
*See NUCLEAR MAGNETIC RESONANCE*
**NUCLEAR STRUCTURE/RESEARCH PROGRAMS**
Nuclear structure studies utilizing LAMPF. Annual progress report, 3:22361 (TREE-1115)
**NUCLEAR WEAPON TESTS**
*See NUCLEAR EXPLOSIONS*
**NUCLEAR WEAPONS/DETONATORS**
Digital RLC analysis of CDU fireset x-units, 3:22138 (BDX-613-1945)
**NUCLEAR WEAPONS/NONDESTRUCTIVE TESTING**
Data aquisition and processing system, 3:22129 (SAND-77-1914C)
**NUCLEAR WEAPONS/SAFEGUARDS**
Computerized site security monitor and response system, 3:21219 (PB-269346)
**NUCLEAR WEAPONS/TRAJECTORIES**
Hybrid trajectory simulation of the B77 system, 3:22140 (SAND-77-8040)
**NUCLEATE BOILING/ACOUSTIC MONITORING**
Acoustic emission in subcooled nucleate pool boiling, 3:21591
**NUCLEATE BOILING/BUBBLE GROWTH**
Nucleate boiling at a liquid-liquid interface, 3:22071
**NUCLEI (CELLS)**
*See CELL NUCLEI*
**NUCLEON-HYPERON INTERACTIONS/CROSS SECTIONS**
Experimental study of $\Lambda p$ and $\Xi^0 p$ interactions in the range 1-10 GeV/c, 3:22337
**NUCLEON-HYPERON INTERACTIONS/ELASTIC SCATTERING**
Experimental study of $\Lambda p$ and $\Xi^0 p$ interactions in the range 1-10 GeV/c, 3:22337

## O

**OCCLUSION COMPLEXES**
*See CLATHRATES*
**OCEAN THERMAL POWER PLANTS/ENERGY TRANSPORT**
Feasibility study of transporting offshore OTEC-produced energy to shore by thermal media. Project 8980 third topical report, November 1976-July 1977, 3:21326 (DSE/2426-19)
**OCEANOGRAPHY/MATHEMATICAL MODELS**
Currents, internal and inertial waves in a stratified ocean due to variable winds. Pt. 2, 3:22287
**OCEANS**
*See SEAS*
**OFF-GAS SYSTEMS/HYGROMETRY**
Continuous water monitor for oil-shale retort effluent, 3:21108 (UCID-17682)
**OFFICE BUILDINGS/SOLAR HEATING SYSTEMS**
System performance of first commercial solar installation in Orange, Virginia (retrofitted office building), 3:21343
**OFF-PEAK ENERGY STORAGE**
Integrating solar heating and off peak electricity usage, 3:21358
Regulatory constraints on solar energy and thermal-storage installations, 3:21746
**OFF-PEAK ENERGY STORAGE/ECONOMICS**
Off-peak energy storage concept for electric utilities: Part I. Electric utility requirements, 3:21521
**OFFSHORE PLATFORMS/CONSTRUCTION**
Dunlin concrete platform--start to finish, 3:20962
**OFFSHORE PLATFORMS/DESIGN**
Dunlin concrete platform--start to finish, 3:20962
Early subsea production system (Modular template system; multi-well (unitised) template system; satellite well system), 3:20981
**OFFSHORE SITES/LEASING**
Outer Continental Shelf Sale 40: inadequate data used to select and evaluate lands to lease. Department of the Interior. Report to the Congress, 3:21729 (PB-269865)
**OIL FIELDS/LEASING**
Outer Continental Shelf Sale 40: inadequate data used to select and evaluate lands to lease. Department of the Interior. Report to the Congress, 3:21729 (PB-269865)
**OIL FIELDS/SIMULATION**
Prediction of reserves and production performance by simulation: Halibut Feld, 3:20980
**OIL SAND DEPOSITS/REMOTE SENSING**
Evaluation of digitally enhanced LANDSAT data as applied to mineral and hydrocarbon exploration, 3:21100
**OIL SANDS/IN-SITU COMBUSTION**
Evaluation of pump used for in situ oil recovery from tar sands, 3:21103 (MTI-78TR16)
**OIL SANDS/IN-SITU PROCESSING**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**OIL SHALE INDUSTRY**
*See also MINERAL INDUSTRY*
**OIL SHALE INDUSTRY/EQUIPMENT**
Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976-August 1977, 3:20840 (FE-2479-1)

**OIL SHALE PROCESSING PLANTS/TECHNOLOGY ASSESSMENT**
Pyrolysis of Carpathian menilitic shales and production of cellular materials from them, 3:21106
**OIL SHALES**
*See also BLACK SHALES*
**OIL SHALES/IN-SITU PROCESSING**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**OIL SHALES/IN-SITU RETORTING**
BX in situ oil shale project. Quarterly progress report No. 1, March 1-May 31, 1977, 3:21104 (TID-27970)
**OIL SHALES/PYROLYSIS**
Pyrolysis of Carpathian menilitic shales and production of cellular materials from them, 3:21106
Thermal decomposition of kuckersite shale in vacuum, 3:21107
**OIL SHALES/RETORTING**
Oil shale retorting: Part 2, variation in product oil chemistry during retorting of an oil shale block, 3:21105 (UCRL-52256(Pt.2))
**OIL SPILLS**
Oil pollution of inland waters in England and Wales, 3:21023
**OIL SPILLS/BIOLOGICAL EFFECTS**
Effect of a bunker fuel on the beach bacterial flora, 3:22273 (CONF-730386-)
Effects of water soluble extracts of oil on phytoplankton, 3:22271 (CONF-730386-)
Interagency investigations of a persistent oil spill on the Washington Coast, 3:22270 (CONF-730386-)
Study of the effects of the San Francisco oil spill on marine organisms, 3:22269 (CONF-730386-)
**OIL SPILLS/CLEANING**
Effects of water soluble extracts of oil on phytoplankton, 3:22271 (CONF-730386-)
Fate of a bunker fuel in beach sand, 3:22211 (CONF-730386-)
Oil pollution control officer training course, 3:21030
Preparation of an oil spill prevention training program, 3:21029
Training a cleanup response team, 3:21028
**OIL SPILLS/CONTROL**
1973 IMCO convention: a tanker operator's viewpoint, 3:21022
Maryland's experience in oil spill prevention and control, 3:21027
Practical oil spill control training school, 3:21032
Stream preservation training, 3:21031
**OIL SPILLS/ENVIRONMENTAL IMPACT STATEMENTS**
Analysis of oil spill accidents for environmental impact statements, 3:21025
**OIL SPILLS/ENVIRONMENTAL IMPACTS**
The METULA oil spill, 3:21019 (PB-270418)
**OIL SPILLS/MEETINGS**
1975 conference on prevention and control of oil pollution, 3:21020
**OIL SPILLS/MONITORING**
Determination of sulfur-containing petroleum components in marine samples, 3:21051
Multielement true boiling point gas chromatograph for monitoring oil pollution, 3:21034
**OIL SPILLS/POLLUTION LAWS**
Offshore oil pollution: law and enforcement, 3:21021
**OIL SPILLS/REMOVAL**
Federal regulatory control of oil spill removal methods, 3:21024
**OIL WELLS**
*See also PETROLEUM*
**OIL WELLS/DRILLING EQUIPMENT**
Obtaining a circular rotating field in a capacitor electrodrill operating at different depths, 3:20966
**OIL WELLS/EXPLOSIVE FRACTURING**
Heavy oil recovery using solvents and explosives, 3:20949 (BERC/RI-77/16)
**OIL WELLS/FLUID INJECTION**
Heavy oil recovery using solvents and explosives, 3:20949 (BERC/RI-77/16)
Oil displacement under elastic operating conditions, 3:20973
**OIL WELLS/GAS GENERATORS**
Ignition process for downhole gas generator (Patent), 3:20960
**OIL WELLS/GAS INJECTION**
Oil recovery by carbon dioxide injection. Annual report, July 1976-July 1977, 3:20954 (ORO-5301-18)
Tertiary oil recovery by $CO_2$ injection. Quarterly report, April-June 1977, 3:20956 (ORO-5303-15)
**OIL WELLS/MAPS**
Wells drilled for oil and gas in Nevada through 1976, 3:20982
**OIL WELLS/MISCIBLE-PHASE DISPLACEMENT**
Oil recovery by carbon dioxide injection. Annual report, July 1976-July 1977, 3:20954 (ORO-5301-18)
Supply of carbon dioxide for enhanced oil recovery. Final report, October 15, 1976-September 1, 1977, 3:20953 (FE-2515-10)
**OIL WELLS/OFFSHORE DRILLING**
Developments in the Irish offshore industry, 3:20961
**OIL WELLS/PRODUCTION**
Drilling technique in the development of the North Sea's Forties Field, 3:20957
**OIL WELLS/WATERFLOODING**
Analysis of the production performance of the Windalia Sand Reservoir of the Barrow Island Oil Field, 3:20979
Improved secondary oil recovery by controlled water flooding-pilot demonstration Ranger Zone, Fault Block VII, Wilmington Field. Phase I. Quarterly report, July-September 1977, 3:20959 (SAN/1396-12)
**OIL WELLS/WELL DRILLING**
Electrodril System Field Test Program, interim phase. Final report, January-April 1977, 3:20950 (BERC/TPR-77/11)
Occurrence, prediction and control of geopressures on the northwest shelf of Australia, 3:20978
Thermostable flushing fluids for well drilling in West Siberia, 3:20965
**OIL WELLS/WELL LOGGING**
Problem of determination of the magnitude of anomalous oil layers clogging bottom hole zones of strata, 3:20974
**OILS**
*See also FUEL OILS*
*SHALE OIL*
*WASTE OILS*
**OILS/SYNTHESIS**
Preliminary experimental plan bench scale research in support of Albany Development Facility, 3:21307 (CONF-770235-)
**OILS/TESTING**
Preliminary experimental plan bench scale research in support of Albany Development Facility, 3:21307 (CONF-770235-)
**ONCOGENIC VIRUSES/INFECTIVITY**
Discrepancy in XC and oncogenicity assays for murine leukemia virus in AKR mice, 3:22245
**ON-LINE CONTROL SYSTEMS/RELIABILITY**
Microcomputer-based reactor safety system, 3:21641 (N-77-26941)
**ONTARIO/RADIATION MONITORING**
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
**ONTARIO/URANIUM DEPOSITS**
Geochemical exploration for uranium in the Grenville province of Ontario, 3:21130
**ONUMA GEOTHERMAL FIELD/GEOLOGY**
Geothermal system of the northern Hachimantai area, 3:21402
**ONUMA GEOTHERMAL FIELD/GEOTHERMAL FIELDS**
Geological remote sensing-evaluation of image data, 3:21408
**OPEC**
*(Organization of Petroleum Exporting Countries.)*
OPEC special fund (To assist DC's and promote new international order), 3:21686
**OPEN-CYCLE MHD GENERATORS/PLASMA SEEDING**
Efficiency of various systems for lead-in and lead-out of an ionizing additive for a power station with an open-cycle MHD generator, 3:21761
**OPEN-CYCLE MHD GENERATORS/SEED RECOVERY**
Efficiency of various systems for lead-in and lead-out of an ionizing additive for a power station with an open-cycle MHD generator, 3:21761
**OREGON/URANIUM DEPOSITS**
Preliminary study of the uranium favorability of tertiary rocks, southeastern Oregon: eastern Klamath, Southern Lake, Harney, and western Malheur Counties, 3:21124 (GJBX-92(77))
**ORES**
*See also IRON ORES*
*URANIUM ORES*
**ORES/HYDRAULIC TRANSPORT**
Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps, 3:22015 (STU-75-5234)
**ORGANIC ACIDS**
*(Excluding NUCLEIC ACIDS and NUCLEOTIDES.)*
*See also CARBOXYLIC ACIDS*
**ORGANIC ACIDS/SYNTHESIS**
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. I. Organic oxygen compounds produced during medium-pressure synthesis with iron catalysts, 3:20869
New concepts and results concerning the mechanism of carbon monoxide hydrogenation. II. Evolution of reaction steps on the basis of detailed product composition and other data, 3:20870
**ORGANIC CHLORINE COMPOUNDS**
*See also CHLORINATED ALIPHATIC HYDROCARBONS*
*CHLOROFORM*
*DDT*
*PVC*
**ORGANIC CHLORINE COMPOUNDS/BIOLOGICAL EFFECTS**
Environmental significance of fin erosion in Southern California demersal fishes (Microstomus pacificus), 3:22219

**ORGANIC NITROGEN COMPOUNDS**
*See also AMINES*
*NITROBENZENE*
*PORPHYRINS*
*PROTEINS*
*PYRIDINES*
**ORGANIC NITROGEN COMPOUNDS/CHEMICAL PREPARATION**
Mannich Bases containing tertiary amines and fuel compositions containing said Mannich Bases (Patent), 3:21982
**ORGANIC NITROGEN COMPOUNDS/GAS CHROMATOGRAPHY**
Nitrogen compounds in coal derived liquids, 3:20894
**ORGANIC NITROGEN COMPOUNDS/MASS SPECTROSCOPY**
Nitrogen compounds in coal derived liquids, 3:20894
**ORGANIC SOLVENTS/PURIFICATION**
Method for increasing the lifetime of an extraction medium used for reprocessing spent nuclear fuel and/or breeder materials (Patent), 3:21154
**ORGANIC SULFUR COMPOUNDS**
*See also SULFONES*
*THIOCYANATES*
*THIOLS*
**ORGANIC SULFUR COMPOUNDS/GAS CHROMATOGRAPHY**
Determination of sulfur-containing petroleum components in marine samples, 3:21051
**ORGANIC WASTES/ANAEROBIC DIGESTION**
Methane gas process and apparatus (Patent), 3:21260
**ORGANOMETALLIC COMPOUNDS**
PVC-stabilizators, 3:21911
**ORGANOMETALLIC COMPOUNDS/CHEMICAL PREPARATION**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**ORGANOMETALLIC COMPOUNDS/CRYSTAL STRUCTURE**
High-precision neutron diffraction investigation of the prototype biscyclopentadienyl transition metal hydride (eta$^5$-$C_5H_5$)$_2$$MoH_2$ and resolution of the structure in terms of modern bonding theory, 3:21951
Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate, 3:21970
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**ORGANOMETALLIC COMPOUNDS/ION CYCLOTRON RESONANCE SPECTROSCOPY**
Negative ion chemistry of (eta$^5$-$C_5H_5$)$Co(CO)_2$ in the gas phase by ion cyclotron resonance spectroscopy. The π-acceptor ability of $PF_3$ compared to CO, 3:21950
**ORGANOMETALLIC COMPOUNDS/MAGNETIC SUSCEPTIBILITY**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**ORMAK DEVICES/ELECTRIC GENERATORS**
ORMAK upgrade ohmic coil generator protection, 3:22603 (ORNL/TM-6079)
**ORMAK DEVICES/GAS FLOW**
Hydrogen transport in a two-dimensional torodial plasma, 3:22469
**ORMAK DEVICES/IMPURITIES**
Impurity studies experiment/ORMAK-upgrade neutral beam systems, 3:22626
Wall power measurements of impurity radiation in ORMAK, 3:22579 (ORNL/TM-6148)
**ORMAK DEVICES/ION TEMPERATURE**
Ion temperature scaling on Jaeri tokamaks, 3:22412
**ORMAK DEVICES/RUNAWAY ELECTRONS**
Dynamics of high energy runaway electrons in the Oak Ridge tokamak, 3:22455 (ORNL/TM-6103)
**OSTEOPOROSIS/DIAGNOSIS**
Quantitation of the degree of osteoporosis by measure of total-body calcium employing neutron activation, 3:22244
**OVARIES/CARCINOMAS**
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr-77-86)
**OVARIES/NEOPLASMS**
Characterization of malignant ovarian tumors by impulse cytophotometry, 3:22236 (LA-tr-77-94)
**OXYGEN/ACTIVATION ANALYSIS**
Fast-neutron activation analysis in coal research, 3:21921
Material balance in coal. 2. Oxygen determination and stoichiometry of 33 coals, 3:20888 (COO-2898-10)
**OXYGEN/ATOM-MOLECULE COLLISIONS**
Deactivation of vibrationally excited ozone by O($^3$P) atoms, 3:22322
Uranium atoms and ions in the gas phase. Progress report, March 1, 1977-February 28, 1978, 3:21141 (COO/4295-1)
**OXYGEN/CHEMICAL REACTION KINETICS**
Reaction and deactivation of HCl (v=1, 2) by O atoms, 3:21949
**OXYGEN/CHEMISORPTION**
Characteristics of American coals in relation to their conversion into clean energy fuels. Quarterly technical progress report, April-June 1977, 3:20889 (FE-2030-8)
**OXYGEN/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**OXYGEN/PRODUCTION**
Photo-electrolytic production of hydrogen (Patent), 3:21245
**OXYGEN 16/ISOTOPIC EXCHANGE**
Oxygen and sulfur isotope equilibria in the $BaSO_4$-$HSO_4^-$-$H_2O$ system from 110 to 350°C and applications, 3:21457
**OXYGEN 16 REACTIONS/COMPOUND-NUCLEUS REACTIONS**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**OXYGEN 16 REACTIONS/FUSION REACTIONS**
Hsub(11/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce, 3:22362
**OXYGEN 16 REACTIONS/INELASTIC SCATTERING**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^4$He and $^{16}$O ions, 3:22370
**OXYGEN 18/ISOTOPIC EXCHANGE**
Oxygen and sulfur isotope equilibria in the $BaSO_4$-$HSO_4^-$-$H_2O$ system from 110 to 350°C and applications, 3:21457
**OXYGEN COMPOUNDS/LATTICE PARAMETERS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**OXYGEN COMPOUNDS/SYNTHESIS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**OXYGEN EFFECT (RADIOBIOLOGY)**
*See OXYGEN*
**OZONE/ATOM-MOLECULE COLLISIONS**
Deactivation of vibrationally excited ozone by O($^3$P) atoms, 3:22322
**OZONE/ENVIRONMENTAL TRANSPORT**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**OZONE/USES**
Use of ozone in treatment and aftertreatment of refinery wastewaters, 3:21012
**OZONE/VIBRATIONAL STATES**
Deactivation of vibrationally excited ozone by O($^3$P) atoms, 3:22322

## P

**PACIFIC OCEAN**
*See also GULF OF CALIFORNIA*
**PACIFIC OCEAN/GEOLOGIC STRUCTURES**
Structure of the Naturaliste Plateau and Trough, 3:20944
**PACKAGING/DESIGN**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**PACKAGING/SAFETY**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**PALLADIUM/CHEMICAL REACTIONS**
Reactions between SiC and Pd or $CeO_2$ at high temperatures (HTGR fuel particles), 3:21576
**PALLADIUM/MUONIC ATOMS**
Circular polarization of muonic x rays and origin of strange $\mu^-$ depolarization in Pd metal, 3:22318
**PALLADIUM 111/BETA-MINUS DECAY**
Lifetime of the 376.7-keV level and shape coexistence in $^{111}$Ag, 3:22363
**PAPER/DRYING**
Radio frequency drying of papers and textiles, 3:21836
**PAPER INDUSTRY/ENERGY CONSUMPTION**
Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 1. Draft target support document, 3:21817 (PB-269819)
Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 2. Appendix to draft target support document, 3:21818 (PB-269820)
Energy efficiency improvement target in the paper and allied products industry (SIC 26). Volume 3. Final target support document, 3:21819 (PB-269821)

**PAPER INDUSTRY/WASTE PRODUCT UTILIZATION**
Sludge from paper production. Final report. Recycling of industrial wastes. Phase II, 3:21840 (BMFT-FB-T-77-08)
**PARABOLIC REFLECTORS**
*See also COMPOUND PARABOLIC CONCENTRATORS*
**PARABOLIC REFLECTORS/OPTICS**
Concentration of diffuse radiation, 3:21372
**PARAFFINS**
*See ALKANES*
**PARAMETRIC INSTABILITIES**
Parametric amplification during interaction of stable and unstable waves, 3:22505
Parametric excitation of low-frequency convective cell modes by a large amplitude lower-hybrid wave in a plasma, 3:22501
**PASSIVE SOLAR HEATING SYSTEMS/PERFORMANCE**
Cortade Library: system performance of first vertical wall passive solar collector array in Orange, Virginia (private library retrofit), 3:21342
**PDX DEVICES/PLASMA MACROINSTABILITIES**
Stabilization of the axisymmetric instability in the PDX tokamak, 3:22478 (PPPL-1400)
**PEARL SPAR**
*See DOLOMITE*
**PELLETS (FUEL)**
*See FUEL PELLETS*
**PENTANE/NUCLEATE BOILING**
Nucleate boiling at a liquid-liquid interface, 3:22071
**PERCHLORIC ACID/CHEMICAL REACTIONS**
Reaction of fluorine and hypofluorous acid with some substitution-inert complex ions in aqueous perchloric acid solutions, 3:21959
**PERMAFROST/TEMPERATURE DISTRIBUTION**
Geothermal studies in the MacKenzie Valley by the Earth Physics Branch, 3:21411
**PERSONNEL**
*See also MINERS*
*RADIOLOGICAL PERSONNEL*
**PERSONNEL/EDUCATION**
Oil pollution control officer training course, 3:21030
Practical oil spill control training school, 3:21032
Preparation of an oil spill prevention training program, 3:21029
Radiation monitor training program at Rocky Flats, 3:22281 (RFP-2434)
Stream preservation training, 3:21031
Training a cleanup response team, 3:21028
**PERSONNEL/RADIATION DOSES**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**PERSONNEL/RADIATION PROTECTION**
Availability and safety of nuclear power stations, 3:21655
General guidelines concerning permitted radiation dosages for inspection personnel and the like at nuclear power plants (Sweden), 3:22260 (ORNL-tr-4547)
**PETROCHEMICAL PLANTS/SLUDGES**
Disposal of petroleum sludges, 3:21017
**PETROCHEMICAL PLANTS/WASTE WATER**
Experience in operating biological treating facilities of Angarsk Petrochemical Combine, 3:21010
Experience in local treatment of wastewaters from petrochemical production, 3:21013
Gas chromatographic method for determination of content of petroleum sulfones in wastewaters, 3:21018
Kinetics of biochemical oxidation of refinery wastewaters, 3:21008
Treatment of waste streams from catalyst manufacturing plants in refineries, 3:21015
**PETROCHEMICALS**
*See also CHEMICAL FEEDSTOCKS*
**PETROCHEMICALS/MODIFICATIONS**
Petrochemical refinery Burghausen. Reversal and expansion of the ethylene production of the German Marathon Petroleum GmbH in Burghausen, 3:20988
**PETROLEUM**
*See also OIL WELLS*
*SHALE OIL*
**PETROLEUM/ACTIVATION ANALYSIS**
Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**PETROLEUM/BIODEGRADATION**
Microbial petroleum degradation: the role of cladosporium resinae, 3:22274 (CONF-730386-)
**PETROLEUM/CHEMICAL ANALYSIS**
Analytical methods for polynuclear aromatic hydrocarbons in crude oils, heating oils, and marine tissues, 3:21052
**PETROLEUM/CHEMICAL COMPOSITION**
Distribution of sulfur compounds in Emba and Mangyshlak crude oils, 3:21047
Experimental equilibrium ratios of a Devonian crude-natural gas system, 3:21039 (CONF-770375-)
**PETROLEUM/DATA COMPILATION**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**PETROLEUM/ENERGY SUPPLIES**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
**PETROLEUM/ENHANCED RECOVERY**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
Oil recovery by carbon dioxide injection. Annual report, July 1976-July 1977, 3:20954 (ORO-5301-18)
Tertiary oil recovery by $CO_2$ injection, 3:20955 (ORO-5302-16)
Tertiary oil recovery by $CO_2$ injection. Quarterly report, April-June 1977, 3:20956 (ORO-5303-15)
**PETROLEUM/FILTRATION**
Models accounting for the phenomenon of delay in liquid filtration through a porous medium, 3:20968
Oil displacement under elastic operating conditions, 3:20973
**PETROLEUM/FLUORESCENCE SPECTROSCOPY**
Identification of petroleum oils by fluorescence spectroscopy, 3:22222
**PETROLEUM/GAS CHROMATOGRAPHY**
Determination of sulfur-containing petroleum components in marine samples, 3:21051
Multielement true boiling point gas chromatograph for monitoring oil pollution, 3:21034
**PETROLEUM/MECHANICAL PROPERTIES**
Evaluation of the information content of oil well products using the data about their structural and mechanical properties, 3:21046
**PETROLEUM/NUCLEAR REACTION ANALYSIS**
Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**PETROLEUM/PHYSICAL PROPERTIES**
Evaluation of the information content of oil well products using the data about their structural and mechanical properties, 3:21046
**PETROLEUM/PRODUCTION**
Liquid hydrocarbon production in the United States, 1946-75 and 1980 projected, highlighting enhanced recovery. Information circular, 3:20958 (PB-269951)
Pricing effects on frontier oil production. Final report, 3:21728 (PB-269807)
**PETROLEUM/QUANTITATIVE CHEMICAL ANALYSIS**
Rapid simultaneous determination of sulfur and vanadium in crude oil using X-ray fluorescence, 3:21932
**PETROLEUM/SEPARATION PROCESSES**
Oil and gas separation on inclined shelves, 3:20969
**PETROLEUM/THERMODYNAMIC PROPERTIES**
Perturbed-hard-chain theory for correlation of thermodynamic properties, 3:21040 (CONF-770375-)
**PETROLEUM/TRANSPORT**
Pipeline design with consideration of the possibility of using a diluent, 3:21037
Review of environmental issues of the transportation of Alaskan North Slope crude oil. Final report (After receiving on West Coast), 3:21730 (PB-270088)
**PETROLEUM/TWO-PHASE FLOW**
Shape of cross section of condensate film in pipes with two-phase flow, 3:21036
**PETROLEUM/UNDERGROUND STORAGE**
Offshore terminal with underground storage at sea, 3:21056
Underground storage of oil and gas, 3:21055
**PETROLEUM DEPOSITS**
*See also GAS CONDENSATE FIELDS*
*OIL FIELDS*
**PETROLEUM DEPOSITS/ELECTRICAL SURVEYS**
Methods for interpretation of geophysical exploration data from heterogeneous carbonate reservoirs with compound porous space (on the example of Lower Cretaceous and Upper Jurassic deposits in ChI ASSR), 3:20946
**PETROLEUM DEPOSITS/EXPLORATION**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
Developments in the Irish offshore industry, 3:20961
Investigations into the carbonaceous reservoirs of the Paleozoic deposit of the South East Dnieper-Donetsk hollow, 3:20945
Mineral exploration and mining in Brasil--1977, 3:20915
Mobile helium sniffer for petroleum, uranium and geothermal prospecting, 3:21136
Nuclear techniques in exploration, extraction and processing of mineral resources. Report on the international symposium held in Vienna from 7 to 10 March 1977, 3:20942
Period of formation of rupture faults in the kyurovdag area section, 3:20943
Petroleum and natural gas exploration in the Federal Republic of Germany in 1976. On the basis of data and drilling results of petroleum companies with activities in the Federal Republic of Germany, 3:20939

Structure and stratigraphy of the Carnarvon Terrace and Wallaby Plateau, 3:22284
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G-77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G-77/357)
**PETROLEUM DEPOSITS/GAS INJECTION**
Tertiary oil recovery by $CO_2$ injection, 3:20955 (ORO-5302-16)
**PETROLEUM DEPOSITS/GEOLOGICAL SURVEYS**
Analysis of the production performance of the Windalia Sand Reservoir of the Barrow Island Oil Field, 3:20979
**PETROLEUM DEPOSITS/LITHOLOGY**
Oil formation in the process of lithogenesis in the light of the systems approach, 3:20940
**PETROLEUM DEPOSITS/PROSPECTING**
Influence of hydrate formation on the information content of indicators of oil-bearing and gas-bearing potential, 3:20941
**PETROLEUM DEPOSITS/REMOTE SENSING**
U.S. Geological Survey project BIRDDOG (basic investigation of remotely detectable deposits of oil and gas), 3:20948
**PETROLEUM DEPOSITS/THICKNESS**
Problem of determination of the magnitude of anomalous oil layers clogging bottom hole zones of strata, 3:20974
**PETROLEUM DISTILLATES/ADDITIVES**
Distillate fuel containing dehazing compositions (Patent), 3:20996
**PETROLEUM INDUSTRY**
*See also MINERAL INDUSTRY*
**PETROLEUM INDUSTRY/ECONOMICS**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
**PETROLEUM INDUSTRY/EQUIPMENT**
Stabilization of essential rotating machinery for the fossil fuel industry. Annual report, August 1976-August 1977, 3:20840 (FE-2479-1)
**PETROLEUM PRODUCTS**
*See also GAS OILS*
*GASOLINE*
*KEROSENE*
*LUBRICATING OILS*
**PETROLEUM PRODUCTS/CHARGES**
Digest of Federal Registers, 3:21733 (PB-270153)
Reference guide to changes in refiner and reseller pricing regulations and rulings, 3:21731 (PB-270151)
Reference guide to changes in reseller pricing regulations and rulings, 3:21732 (PB-270152)
**PETROLEUM PRODUCTS/CHEMICAL COMPOSITION**
Distribution of sulfur compounds in Emba and Mangyshlak crude oils, 3:21047
**PETROLEUM PRODUCTS/FLOW MODELS**
Calculation of the time of flow of a film of a viscous petroleum product from the inner surface of railroad tank-cars, 3:21038
**PETROLEUM PRODUCTS/MARKET**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
**PETROLEUM PRODUCTS/QUANTITATIVE CHEMICAL ANALYSIS**
Distribution of nitrogen in the refining products of some types of petroleum of the subcarpathian region, 3:21043
**PETROLEUM PRODUCTS/RAIL TRANSPORT**
Calculation of the time of flow of a film of a viscous petroleum product from the inner surface of railroad tank-cars, 3:21038
**PETROLEUM PRODUCTS/REGULATIONS**
Digest of Federal Registers, 3:21733 (PB-270153)
Reference guide to changes in refiner and reseller pricing regulations and rulings, 3:21731 (PB-270151)
Reference guide to changes in reseller pricing regulations and rulings, 3:21732 (PB-270152)
**PETROLEUM PRODUCTS/TRANSPORT**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
**PETROLEUM PRODUCTS/UNDERGROUND STORAGE**
Use of concrete in the new terrastore underground storage system, 3:21057
**PETROLEUM REFINERIES**
Investigation of the operation of a gas separation unit of a catalytic reforming installation, 3:20992
**PETROLEUM REFINERIES/CONSTRUCTION**
Turbo proposes new refinery concept, 3:20990
**PETROLEUM REFINERIES/CORROSION**
Corrosion control and selection of materials for refinery equipment, 3:20994
**PETROLEUM REFINERIES/HEAT EXCHANGERS**
Selection of location for removal of heat of absorption in a tower, 3:20995
**PETROLEUM REFINERIES/MODIFICATIONS**
Petrochemical refinery Burghausen. Reversal and expansion of the ethylene production of the German Marathon Petroleum GmbH in Burghausen, 3:20988
**PETROLEUM REFINERIES/OPERATION**
Simplified calculation of rectification column minimum reflux conditions, 3:20991
**PETROLEUM REFINERIES/SLUDGES**
Disposal of petroleum sludges, 3:21017
**PETROLEUM REFINERIES/TECHNOLOGY UTILIZATION**
Turbo proposes new refinery concept, 3:20990
**PETROLEUM REFINERIES/WASTE WATER**
Concentrating waste streams from electric desalting units by means of contact evaporators, 3:21016
Experience in operating biological treating facilities of Angarsk Petrochemical Combine, 3:21010
Experience in local treatment of wastewaters from petrochemical production, 3:21013
Experience in the use of polyurethane foam as a filter material in treating oil-containing wastewaters, 3:21014
Kinetics of biochemical oxidation of refinery wastewaters, 3:21008
Treatment of wastewaters from succinimide additive production unit at Perm' Petroleum Refinery, 3:21011
Treatment of waste streams from catalyst manufacturing plants in refineries, 3:21015
Use of ozone in treatment and aftertreatment of refinery wastewaters, 3:21012
Use of technical oxygen for biochemical treatment of refinery wastewaters, 3:21009
**PETROLEUM RESIDUES/CARBONIZATION**
Desulfurization of petroleum residues and their carbonization properties, 3:20985
**PETROLEUM RESIDUES/DESULFURIZATION**
Desulfurization of petroleum residues and their carbonization properties, 3:20985
**PETROLEUM RESIDUES/ENHANCED RECOVERY**
Investigation of the flow of an aqueous solution of polyacrylamide in narrow slots, 3:20975
**PETROLEUM RESIDUES/GRAPHITIZATION**
Desulfurization of petroleum residues and their carbonization properties, 3:20985
**PETROLEUM RESIDUES/THERMAL GRAVIMETRIC ANALYSIS**
Thermogravimetric investigation of oxidative polycondensation of petroleum residual stocks, 3:21048
**PHENOL/REMOVAL**
Treatability studies of condensate water from Synthane coal gasification, 3:20904 (PERC/RI-77/13)
**PHOSPHATE ROCKS/MINING**
Radon and radon daughter measurements and methods utilized by EPA's Eastern Environmental Radiation Facility (Radioactivity of air in buildings constructed on land reclaimed from phosphate mining), 3:22189 (HASL-325)
**PHOSPHATE ROCKS/NATURAL RADIOACTIVITY**
Application of field spectrometry to radiation studies in phosphate regions, 3:22188 (HASL-325)
**PHOSPHATE ROCKS/RADIOACTIVITY**
Radon and radon daughter measurements and methods utilized by EPA's Eastern Environmental Radiation Facility (Radioactivity of air in buildings constructed on land reclaimed from phosphate mining), 3:22189 (HASL-325)
**PHOSPHATES/ORE PROCESSING**
Method to recover uranium from uranium-containing phosphate ores (Patent), 3:21138
**PHOSPHORUS/GAS CHROMATOGRAPHY**
Spectroscopic element detector for gas chromatography, 3:21929
**PHOSPHORUS/SPECTROSCOPY**
Spectroscopic element detector for gas chromatography, 3:21929
**PHOSPHORUS/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**PHOSPHORUS 32/ENVIRONMENTAL TRANSPORT**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**PHOSPHORUS 33/ENVIRONMENTAL TRANSPORT**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**PHOTOCHEMICAL REACTIONS**
*See also PHOTOSYNTHESIS*
**PHOTOCHEMICAL REACTIONS/MATHEMATICAL MODELS**
Effect of selected parameters on predictions of a photochemical model, 3:21988 (PB-269858)
**PHOTOELECTROLYTIC CELLS/DESIGN**
Photoelectrolysis of water by solar radiation (Patent), 3:21315
Solar energy conversion (Patent), 3:21314
**PHOTOELECTROLYTIC CELLS/MEETINGS**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)

**PHOTOGALVANIC CELLS/EFFICIENCY**
Photochemical conversion of solar energy. Annual report, January 1, 1974-December 31, 1974 (Iron-thionine), 3:21316 (NSF/RANN/SE/AER-72-03597/A03/74/4)
**PHOTOGALVANIC CELLS/MEETINGS**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
**PHOTOGALVANIC CELLS/PHOTOCHEMISTRY**
Photochemical conversion of solar energy. Annual report, January 1, 1974-December 31, 1974 (Iron-thionine), 3:21316 (NSF/RANN/SE/AER-72-03597/A03/74/4)
**PHOTOGALVANIC CELLS/RESEARCH PROGRAMS**
Photochemical conversion of solar energy. Annual report, January 1, 1974-December 31, 1974 (Iron-thionine), 3:21316 (NSF/RANN/SE/AER-72-03597/A03/74/4)
**PHOTON-NUCLEON INTERACTIONS/PAIR PRODUCTION**
Weak neutral currents and photoproduction of lepton pairs, 3:22343
**PHOTON-NUCLEON INTERACTIONS/WEAK NEUTRAL CURRENTS**
Weak neutral currents and photoproduction of lepton pairs, 3:22343
**PHOTOSYNTHESIS/MEETINGS**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
**PHOTOSYNTHESIS/SIMULATION**
Biomimetic approach to solar energy conversion, 3:21308 (CONF-770582-1)
**PHWR TYPE REACTORS/ECONOMICS**
Commercial electric power cost studies. Capital cost, Pressurized Heavy Water Reactor Plant, 3:21596 (COO-2477-13(Vol.1))
**PHYTOPLANKTON**
*See also ALGAE*
**PHYTOPLANKTON/BIOLOGICAL EFFECTS**
Effects of water soluble extracts of oil on phytoplankton, 3:22271 (CONF-730386-)
**PION MINUS REACTIONS/KNOCK-OUT REACTIONS**
Definitive test of outgoing-nucleon analog charge exchange using the reactions $^{12}C(\pi^{+-},\ ^{12}C$(4.44 and 15.11 MeV), 3:22355
**PION PLUS REACTIONS/KNOCK-OUT REACTIONS**
Definitive test of outgoing-nucleon analog charge exchange using the reactions $^{12}C(\pi^{+-},\ ^{12}C$(4.44 and 15.11 MeV), 3:22355
**PION REACTIONS/CHARGE-EXCHANGE REACTIONS**
Proposal for an experimental program at SIN. Study of pion-nucleus scattering using a magnetic spectrometer (Proposed experimental program), 3:22367 (LA-tr-84)
**PION REACTIONS/FINAL-STATE INTERACTIONS**
Proposal for an experimental program at SIN. Study of pion-nucleus scattering using a magnetic spectrometer (Proposed experimental program), 3:22367 (LA-tr-84)
**PION REACTIONS/TOTAL CROSS SECTIONS**
Total pion cross section measurements. Annual progress report, January 1, 1975-December 31, 1975 (20 to 250 MeV summaries of research activities at the University of Montana), 3:22358 (RLO-2232-T1-4)
**PION-DEUTERON INTERACTIONS/PARTICLE PRODUCTION**
Proposal for an experiment at the SIN: determination of D-state admixture in deuterons with the aid of $\pi^+$-d scattering, 3:22338 (LA-tr-77-74)
**PIONS**
*See also PIONS PLUS*
**PIONS/BIOLOGICAL RADIATION EFFECTS**
Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr-77-75)
Effect of pions on the embryonal development of the mouse, 3:22263 (LA-tr-77-77B)
Effect of pions on germ cells and occurrence of mutations, 3:22262 (LA-tr-77-67)
**PIONS PLUS/MASS**
Proposal for an experiment at SIN: precision measurements of $\mu^+$-impulses from disintegration of arrested pions, 3:22332 (LA-tr-77-76)
**PIPELINE QUALITY GAS**
*See HIGH BTU GAS*
**PIPELINES**
*See also NATURAL GAS DISTRIBUTION SYSTEMS*
*SLURRY PIPELINES*
**PIPELINES/CONSTRUCTION**
Geothermal resources operational Order No. 6: pipelines and surface production facilities, 3:21417
**PIPELINES/DESIGN**
Pipeline design with consideration of the possibility of using a diluent, 3:21037
**PIPELINES/ENVIRONMENTAL IMPACTS**
Geothermal resources operational Order No. 6: pipelines and surface production facilities, 3:21417
Review of environmental issues of the transportation of Alaskan North Slope crude oil. Final report (After receiving on West Coast), 3:21730 (PB-270088)
**PIPELINES/EXPANSION JOINTS**
Investigations of displacements of open sections of pipelines, 3:21096
**PIPELINES/LEAK TESTING**
Statistical method of locating gas leaks along a gas pipeline route, 3:21095
**PLANTS**
*See also ALGAE*
*AQUATIC ORGANISMS*
*BIOMASS*
*COTTON PLANTS*
*FUNGI*
*TREES*
**PLANTS/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**PLANTS/ECOLOGY**
Old field vegetation as an inhibitor of tree vegetation, 3:22199
**PLANTS/ENDANGERED SPECIES**
Endangered and threatened plant species of the Nevada Test Site, Ash Meadows, and central-southern Nevada, 3:22198 (COO-2307-13)
**PLANTS/PLANT GROWTH**
Selective planting for the encouragement of wildlife, 3:21545
**PLANTS/RADIONUCLIDE KINETICS**
Evaluation of the radionuclide concentrations in soil and plants from the 1975 terrestrial survey of Bikini and Eneu Islands, 3:22201 (UCRL-51879(Pt.3))
**PLANTS (INDUSTRIAL)**
*See INDUSTRIAL PLANTS*
**PLASMA**
*See also BEAM-PLASMA SYSTEMS*
*COLD PLASMA*
*COLLISIONAL PLASMA*
*COLLISIONLESS PLASMA*
*HIGH-BETA PLASMA*
*HOMOGENEOUS PLASMA*
*INHOMOGENEOUS PLASMA*
*LASER-PRODUCED PLASMA*
**PLASMA/CORRELATION FUNCTIONS**
Long time behavior of the velocity autocorrelation function in a plasma, 3:22461
**PLASMA/DISTRIBUTION FUNCTIONS**
Methods of 'tailoring' ion distributions in phase space ('morphodynamics'), 3:22445
**PLASMA/ELECTRIC CONDUCTIVITY**
Conduction mode variation and inertial conductivity, 3:22498
**PLASMA/ELECTRIC CURRENTS**
Computer simulation of current penetration in a plasma, 3:22485
**PLASMA/ELECTRON BEAM INJECTION**
Formation of strong E-layers by intense electron-beam injection into preformed plasmas, 3:22406
**PLASMA/ELECTRON-ATOM COLLISIONS**
Stability of a low-temperature plasma, 3:22500
**PLASMA/ION DENSITY**
Methods of 'tailoring' ion distributions in phase space ('morphodynamics'), 3:22445
**PLASMA/KINETIC EQUATIONS**
Multiple spatial scaling and the weak coupling approximation. II. Homogeneous kinetic equation, 3:22466
Stability of a low-temperature plasma, 3:22500
**PLASMA/NEUTRAL-PARTICLE TRANSPORT**
Analytical solution for the distribution of neutral particles in a Maxwellian plasma using the method of singular eigenfunctions, 3:22462
**PLASMA/POTENTIAL ENERGY**
Electrostatic potential in a low-density plasma in toroidal systems, 3:22464
**PLASMA/RESEARCH PROGRAMS**
Experimental and theoretical work in plasma physics. Annual status report, 31 December 1975, 3:22448 (N-77-26985)
**PLASMA/ROTATION**
Investigation of particle velocities in a 'critical velocity' rotating plasma, 3:22452
**PLASMA/SHOCK WAVES**
Outer shock structure of shock-waves propagating in partially ionized gases, 3:22528
**PLASMA/TEST PARTICLES**
Test charge problem in the theory of bounded plasmas, 3:22467
**PLASMA/THERMAL EQUILIBRIUM**
Thermal equilibrium in plasmas containing negative ions. II, 3:22444
**PLASMA CONFINEMENT**
Containment of an adiabatic plasma on magnetic lines of force by a self-generated electrostatic field, 3:22410

**PLASMA DIAGNOSTICS**
Discussion of diagnostics techniques in particle beam fusion at Sandia Laboratories, 3:22421 (SAND-77-1829C)
**PLASMA DIAGNOSTICS/ALPHA SPECTRA**
Pinhole imaging of laser-produced thermonuclear alpha particles, 3:22424 (UCRL-79780)
**PLASMA DIAGNOSTICS/CAVITY RESONATORS**
Three-laser intercavity interferometer for the study of low-density plasmas, 3:22432
**PLASMA DIAGNOSTICS/DOPPLER EFFECT**
Flow velocity measurement in high-current arcs using Doppler-shifted plasma scattering, 3:22435
**PLASMA DIAGNOSTICS/FARADAY EFFECT**
10.6 μm interferometry and Faraday rotation measurements on a theta-pinch plasma, 3:22433
**PLASMA DIAGNOSTICS/IMAGE CONVERTERS**
High-speed image converters for studying laser radiation with picosecond and femtosecond time resolution, 3:22431 (UCRL-Trans-11298)
**PLASMA DIAGNOSTICS/INTERFEROMETRY**
10.6 μm interferometry and Faraday rotation measurements on a theta-pinch plasma, 3:22433
Interferometry and luminosity measurements on a $CO_2$ laser plasma focus, 3:22426
**PLASMA DIAGNOSTICS/LASER RADIATION**
Investigation of perturbation of a laser plasma density profile by the high-speed interferometry method, 3:22439
Scheme for $CO_2$ laser scattering to measure the ion temperature in a tokamak plasma, 3:22441
**PLASMA DIAGNOSTICS/M CODES**
Diagnostic programs used with McGUS a 3D mirror equilibrium code, 3:22422 (UCID-17650)
**PLASMA DIAGNOSTICS/MAGNETOACOUSTIC WAVES**
Determination of plasma density and temperature profiles using magneto-acoustic oscillations, 3:22436
**PLASMA DIAGNOSTICS/MICROWAVE RADIATION**
Determination of electron velocity distribution from the microwave emission of a low-temperature plasma, 3:22438
**PLASMA DIAGNOSTICS/PHOTOGRAPHY**
Studies of pellet evaporation by $CO_2$ laser, using multiple-frame argon-ion laser shadow photography, 3:22434
**PLASMA DIAGNOSTICS/THOMSON SCATTERING**
Measurements of the parametric decay of $CO_2$ laser radiation into plasma waves at quarter critical density using ruby laser Thomson scattering, 3:22420 (PPPL-1394)
Status of the USA program on the development of submillimeter lasers to measure ion temperatures, 3:22419 (CONF-770954-5)
**PLASMA DIAGNOSTICS/ULTRAVIOLET SPECTRA**
Spatially resolved EUV emission from focused REB discharges into thin targets, 3:22427
**PLASMA DIAGNOSTICS/X-RAY SPECTRA**
Sub-keV, subnanosecond measurements of x-ray spectra from laser-produced plasmas, 3:22425 (UCRL-79782)
**PLASMA DRIFT/ANALYTICAL SOLUTION**
Neoclassical diffusion in toroidal three-cut magnetic field, 3:22471
**PLASMA DRIFT/ELECTROMAGNETIC FIELDS**
Generation of electric and diffusion currents (magnetic fields) in arbitrarily moving media by electromagnetic radiation, 3:22463
**PLASMA FOCUS DEVICES/ENERGY SPECTRA**
Method of studying the spectral composition of powerful high-energy deuteron beams formed in a plasma focus, 3:22451 (UCRL-Trans-11307)
**PLASMA FOCUS DEVICES/PERFORMANCE**
Experimental investigation of the operating characteristic of a plasma focus, 3:22447 (LA-tr-77-69)
**PLASMA FOCUS DEVICES/PLASMA HEATING**
Effectiveness of interaction of an electron flux with high $\nu/\gamma$ with preliminary heating of a plane target, 3:22415 (ORNL-tr-4537)
**PLASMA FOCUS DEVICES/REVIEWS**
Experimental investigation of the operating characteristic of a plasma focus, 3:22447 (LA-tr-77-69)
**PLASMA HEATING**
*See also HIGH-FREQUENCY HEATING*
*LASER-RADIATION HEATING*
*SHOCK HEATING*
*TURBULENT HEATING*
**PLASMA HEATING/ALPHA REACTIONS**
Alpha particle effects on the reversal field mirror, 3:22417
**PLASMA HEATING/RUNAWAY ELECTRONS**
Quasi-linear relaxation of runaway electrons in a hf heated tokamak plasma, 3:22414
**PLASMA INSTABILITY**
*See also CONVECTIVE INSTABILITIES*
*EXPLOSIVE INSTABILITY*
*HOSE INSTABILITY*
*PARAMETRIC INSTABILITIES*
*PLASMA MACROINSTABILITIES*
*PLASMA MICROINSTABILITIES*
*TWO-STREAM INSTABILITY*
**PLASMA INSTABILITY/ELECTRIC CONDUCTIVITY**
Conduction mode variation and inertial conductivity, 3:22498
Resistive instability of a low-beta plasma cylinder without assumed mode localization, 3:22497
**PLASMA INSTABILITY/INSTABILITY GROWTH RATES**
Spatial growth of filamentation instability in a collisionless magnetoplasma, 3:22493
**PLASMA JETS/PLASMA DIAGNOSTICS**
Diagnostics of an rf induction plasma torch with the aid of a magnetic probe, 3:22430
**PLASMA MACROINSTABILITIES**
*See also KINK INSTABILITY*
**PLASMA MACROINSTABILITIES/STABILIZATION**
Stabilization of the axisymmetric instability in the PDX tokamak, 3:22478 (PPPL-1400)
**PLASMA MICROINSTABILITIES**
*See also CYCLOTRON INSTABILITY*
*DRIFT INSTABILITY*
*LOSS CONE INSTABILITY*
*TWO-STREAM INSTABILITY*
**PLASMA MICROINSTABILITIES/PLASMA SIMULATION**
Computer simulation of current penetration in a plasma, 3:22485
**PLASMA SIMULATION/CALCULATION METHODS**
Higher-order multipoles and splines in plasma simulations, 3:22457 (PPPL-1404)
**PLASMA WAVES**
*See also ELECTRON PLASMA WAVES*
*ION ACOUSTIC WAVES*
**PLASMA WAVES/DISTRIBUTION FUNCTIONS**
Suppression of the plasma oscillation by a wave perturbation on the beam distribution function, 3:22518
**PLASMA WAVES/EXCITATION**
Convective excitation of quasistatic waves in an inhomogeneous anisothermic plasma. II. Nonlinear estimates, 3:22527
**PLASMA WAVES/HYBRID RESONANCE**
Nonlinear development of lower hybrid cones, 3:22486
**PLASMA WAVES/INTERACTIONS**
Parametric amplification during interaction of stable and unstable waves, 3:22505
**PLASMA WAVES/LANGMUIR FREQUENCY**
Nonlinear dissipation effects on spectra of the strong Langmuir turbulence, 3:22532
Parametric excitation of Langmuir waves in an inhomogeneous plasma, 3:22516
**PLASMA WAVES/MATHEMATICAL MODELS**
Some models of wave collapses, 3:22531
**PLASMA WAVES/NONLINEAR PROBLEMS**
Nonlinear development of lower hybrid cones, 3:22486
**PLASMA WAVES/PARAMETRIC INSTABILITIES**
Measurements of the parametric decay of $CO_2$ laser radiation into plasma waves at quarter critical density using ruby laser Thomson scattering, 3:22420 (PPPL-1394)
**PLASMA WAVES/SHORT WAVE RADIATION**
Ponderomotive force and dc magnetic field generation induced by laser absorption, 3:22509
**PLASMA WAVES/TURBULENCE**
Nonlinear dissipation effects on spectra of the strong Langmuir turbulence, 3:22532
Renormalization method and singularities in the theory of Langmuir turbulence, 3:22520
**PLASMA WAVES/WAVE PROPAGATION**
Filamentation of large amplitude lower-hybrid waves, 3:22496
**PLASTICS**
*See also POLYSTYRENE*
*POLYURETHANES*
**PLASTICS/FIRE RESISTANCE**
Flame resistance for plastics and chemical fibers, 3:22076
**PLATINUM/PHOTOEMISSION**
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL-6906)
**PLATINUM/SORPTIVE PROPERTIES**
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL-6906)
**PLATINUM BASE ALLOYS/PHYSICAL RADIATION EFFECTS**
Fission-fragment-induced helium blistering of $^{252}$Cf-exposed surfaces, 3:22679 (DP-MS-77-47)
**PLATINUM COMPLEXES/CRYSTAL STRUCTURE**
Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate, 3:21970
**PLATINUM COMPLEXES/RADIATION SCATTERING ANALYSIS**
X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts, 3:21935
**PLBR REACTOR/REACTOR CORES**
Radial parfait core design study, 3:21590 (WARD-353)

**PLT DEVICES**
*(Princeton Large Torus.)*
**PLT DEVICES/ENERGY BALANCE**
Ion energy balance in ohmically heated PLT discharges, 3:22449 (PPPL-1403)
**PLT DEVICES/ION TEMPERATURE**
Ion energy balance in ohmically heated PLT discharges, 3:22449 (PPPL-1403)
**PLT DEVICES/NEUTRAL BEAM SOURCES**
PLT neutral particle injectors, 3:22625
**PLUMES/MATHEMATICAL MODELS**
First annual report on weather modification effects of cooling towers, 3:22149 (TID-27836)
**PLUMES/RADIATION DOSE DISTRIBUTIONS**
Applicability of accepted diffusion models to near stack dose calculations, 3:22193
**PLUTONIUM/CALORIMETRY**
Calorimetric assay of plutonium. Technical report, 3:21220 (PB-270656)
**PLUTONIUM/ENVIRONMENTAL TRANSPORT**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208
**PLUTONIUM/EXTRACTION CHROMATOGRAPHY**
Investigation of special resins for the extraction-chromatogaphic separation of Np and Pu from the process stream of a reprocessing plant for HTR fuel elements, 3:21158 (GERHTR-181)
**PLUTONIUM/GAMMA SPECTROSCOPY**
Nondestructive analysis methods for the measurement of special nuclear materials, 3:21229
**PLUTONIUM/HEALTH HAZARDS**
Inhalation of dust contaminated with plutonium: Possible health effects. Health considerations of proposed residential development of land contaminated with plutonium in the Denver area, 3:21210 (HRP-0006798)
**PLUTONIUM/NUCLEAR REACTION ANALYSIS**
Nondestructive analysis methods for the measurement of special nuclear materials, 3:21229
Reduced variance multiplication meter for plutonium sample verification and assay applications, 3:21234
Thermal-neutron coincidence counting of large plutonium samples, 3:21230
**PLUTONIUM/RADIOECOLOGICAL CONCENTRATION**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208
**PLUTONIUM/SELF-DIFFUSION**
Anomalous self-diffusion in rare earths and actinides, 3:21892
**PLUTONIUM 238/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
**PLUTONIUM 238/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**PLUTONIUM 238/TOXICITY**
Relative occupational risks of plutonium and $^{233}$U fuels, 3:22266
**PLUTONIUM 239/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**PLUTONIUM 239/INHALATION**
Estimate of early mortality and morbidity following acute inhalation of plutonium, 3:22255
**PLUTONIUM 239/RADIATION MONITORING**
Measuring low concentrations of plutonium and americium in earth samples, 3:22202
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**PLUTONIUM 239/RADIOECOLOGICAL CONCENTRATION**
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**PLUTONIUM 239 TARGET/NEUTRON REACTIONS**
Delayed neutron spectra from $^{232}$Th, $^{233}$U, $^{235}$U, and $^{239}$Pu, 3:22379 (RLO/2225/T3-6)
**PLUTONIUM 240/ENVIRONMENTAL TRANSPORT**
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**PLUTONIUM 240/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**PLUTONIUM 241/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**PLUTONIUM ALLOYS/CASTING**
Present position of electron beam melting and casting technology, 3:21837
**PLUTONIUM ALLOYS/ELECTRON BEAM MELTING**
Present position of electron beam melting and casting technology, 3:21837
**PLUTONIUM CARBIDES/BURNUP**
Study of uranium-plutonium carbide-based fuel simulating high burnup, 3:21150
**PLUTONIUM CARBIDES/TEMPERATURE GRADIENTS**
Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient, 3:21149
**PLUTONIUM DIOXIDE/CRITICALITY**
Basis for subcritical limits in proposed criticality safety standard for mixed oxides, 3:21215
**PLUTONIUM ISOTOPES/SPONTANEOUS FISSION**
Spontaneously fissioning isomers, 3:22375
**PLUTONIUM NITRIDES/TEMPERATURE GRADIENTS**
Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient, 3:21149
**PLUTONIUM OXIDES/TRANSPORT**
Study of plutonium oxide leak rates from shipping containers. Quarterly progress report, April 1, 1977-June 30, 1977, 3:22013 (BNWL-2260-3)
**PNEUMOCONIOSES/LEGISLATION**
Program to pay black lung benefits to coal miners and their survivors: improvements are needed. Departments of Labor and Health, Education, and Welfare, 3:21689 (PB-269875)
**POLLUTION CONTROL/PERSONNEL**
Oil pollution control officer training course, 3:21030
Practical oil spill control training school, 3:21032
Preparation of an oil spill prevention training program, 3:21029
Stream preservation training, 3:21031
Training a cleanup response team, 3:21028
**POLLUTION CONTROL AGENCIES**
Federal regulatory control of oil spill removal methods, 3:21024
**POLLUTION CONTROL EQUIPMENT**
*See also AFTERBURNERS*
*ELECTROSTATIC PRECIPITATORS*
*SCRUBBERS*
**POLLUTION CONTROL EQUIPMENT/DESIGN**
Process for separation and recovery of carbon monoxide (Patent), 3:22094
**POLLUTION CONTROL EQUIPMENT/ECONOMICS**
Air pollution cleaning needs varied approach, 3:22095
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
**POLLUTION CONTROL EQUIPMENT/FINANCING**
Financing nuclear power plant pollution controls, 3:21620
**POLLUTION CONTROL EQUIPMENT/PERFORMANCE**
Air pollution cleaning needs varied approach, 3:22095
Costly business of purifying noxious emissions, 3:22093
**POLLUTION LAWS**
Federal regulatory control of oil spill removal methods, 3:21024
**POLLUTION LAWS/ENFORCEMENT**
Offshore oil pollution: law and enforcement, 3:21021
**POLONIUM 210/RADIATION MONITORING**
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**POLONIUM 214/RADIATION MONITORING**
3R-WL air sampling survey meter (Uranium mine air monitor), 3:22171 (HASL-325)
Estimation of $^{222}$Rn daughter doses from large-area sources, 3:22195
**POLONIUM 215/NUCLEAR STRUCTURE**
Nuclear data sheets for A=215, 3:22372
**POLONIUM 218/RADIATION MONITORING**
3R-WL air sampling survey meter (Uranium mine air monitor), 3:22171 (HASL-325)
Estimation of $^{222}$Rn daughter doses from large-area sources, 3:22195
Variation of radon and radon daughter concentrations with height above ground, 3:22177 (HASL-325)
**POLYAMIDES**
*See also POLYURETHANES*
**POLYAMIDES/FLUID FLOW**
Investigation of the flow of an aqueous solution of polyacrylamide in narrow slots, 3:20975
**POLYAMIDES/VISCOSITY**
Investigation of the flow of an aqueous solution of polyacrylamide in narrow slots, 3:20975
**POLYCYCLIC AROMATIC HYDROCARBONS/GAS CHROMATOGRAPHY**
Analytical methods for polynuclear aromatic hydrocarbons in crude oils, heating oils, and marine tissues, 3:21052

**POLYHYDROXYAROMATICS**
*See POLYPHENOLS*
**POLYPHENOLS/SOLVOLYSIS**
Solvolysis extraction using quinoline and phenol resin as coal model, 3:20885
**POLYSTYRENE/WEATHERING**
Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July-September 1977, 3:21275 (ERDA/JPL/954458-77/6)
**POLYURETHANES**
Experience in the use of polyurethane foam as a filter material in treating oil-containing wastewaters, 3:21014
**POLYURETHANES/FABRICATION**
Investigating the geometric quality of cast polyurethane-foam duplicates for solar-energy concentrators, 3:21373
**POLYURETHANES/MANUFACTURING**
Development of an automated foam processing system. Final report, 3:21910 (BDX-613-1691(Rev.))
**POLYURETHANES/QUALITY CONTROL**
Development of an automated foam processing system. Final report, 3:21910 (BDX-613-1691(Rev.))
**POPULATIONS**
*See also HUMAN POPULATIONS*
**POPULATIONS/SURVIVAL TIME**
Average number of generations until extinction and rate of allelism of lethal genes in a sub-divided population (Drosophila), 3:22239 (RLO/2225/T5-35)
**PORPHYRINS/ELECTRONIC STRUCTURE**
Stereolectronic properties of aggregate chlorophyll systems. Progress report, January 1-December 31, 1977, 3:21975 (COO-2837-3)
**PORPHYRINS/STEREOCHEMISTRY**
Stereolectronic properties of aggregate chlorophyll systems. Progress report, January 1-December 31, 1977, 3:21975 (COO-2837-3)
**POSITION INDICATORS**
*See DISPLACEMENT GAGES*
**POSITRON CAMERAS/NOISE**
Noise in 3-D imaging with large-area positron cameras, 3:22124
**POSITRONS/ANNIHILATION**
Theory of the temperature dependence of positron bulk lifetimes-implications for vacancy formation enthalpy measurements via positron experiments, 3:22317 (CONF-761027-26)
**POSITRONS/DIFFUSION**
Diffusion of light particles in metals, 3:22392
**POSITRONS/TRAPPING**
Diffusion of light particles in metals, 3:22392
**POTASSIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**POTASSIUM ALLOYS/CHEMICAL PREPARATION**
Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972-31 May 1975, 3:21871 (AD-A-042253)
**POTASSIUM ALLOYS/PHYSICAL RADIATION EFFECTS**
Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972-31 May 1975, 3:21871 (AD-A-042253)
**POTASSIUM CHLORIDES/CHEMICAL RADIATION EFFECTS**
Radiation effects on salt relevant to nuclear waste disposal in salt deposits (γ-rays), 3:21173
**POTASSIUM CHLORIDES/PHYSICAL RADIATION EFFECTS**
Radiation effects on salt relevant to nuclear waste disposal in salt deposits (γ-rays), 3:21173
**POTASSIUM COMPOUNDS/CRYSTAL STRUCTURE**
Tripotassium hydroxylaminetrisulfonate sesquihydrate, neutron data, 3:21968
**POTASSIUM COMPOUNDS/RADIATION SCATTERING ANALYSIS**
X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts, 3:21935
**POWDER METALLURGY/ENERGY CONSERVATION**
How to decrease the energy demand of powder metallurgy furnaces, 3:21832
**POWER DEMAND/MEETINGS**
Proceedings of the twelfth session of the Sub-Committee on Energy Resources and Electric Power, 3:21745
**POWER GENERATION**
Transition to decentralized energy systems (Comparison of annualized costs and reliability of centralized and decentralized systems), 3:21739 (CONF-7710101-1)
**POWER GENERATION/COAL**
Status of coal supply contracts for new electric generating units, 1976-1985, 3:21727 (TID-28066)
**POWER GENERATION/COST**
Modifications and costs of converting to low sulfur western coals, 3:21522 (CONF-771024-3)
**POWER GENERATION/EVALUATION**
Impacts of the western drought on the regional electricity situation (Pacific Northwest), 3:21743 (TID-28064)
**POWER GENERATION/MEETINGS**
Proceedings of the twelfth session of the Sub-Committee on Energy Resources and Electric Power, 3:21745
**POWER REACTORS**
*See also ALMARAZ-1 REACTOR*
*ALMARAZ-2 REACTOR*
*CLINCH RIVER BREEDER REACTOR*
*PLBR REACTOR*
*PROCESS HEAT REACTORS*
*THTR-300 REACTOR*
*VRAIN REACTOR*
**POWER REACTORS/REACTOR ACCIDENTS**
Reportable occurrences at nuclear reactors and their causes, 3:21654
**POWER SUBSTATIONS/CONTROL SYSTEMS**
Application of microcomputers to the protection and control of power system substations, 3:21541
**POWER SUBSTATIONS/SECURITY**
Application of microcomputers to the protection and control of power system substations, 3:21541
**POWER SYSTEMS/CONTROL**
Control interfaces of generation allocation of the large interconnected power system, 3:21470
**POWER SYSTEMS/DESIGN**
Electrical power generation and distribution system (Patent), 3:21532
**POWER SYSTEMS/ENERGY SOURCES**
Waste energy source utilization circuit and method (Patent), 3:21517
**POWER SYSTEMS/EQUIPMENT PROTECTION DEVICES**
Fast-tripping operation of the coupling bay protection in case of faults in the immediate vicinity of the busbars, 3:21536
**POWER SYSTEMS/FEEDBACK**
Application of the statistical theory of feedback to power system identification, 3:21540
**POWER SYSTEMS/LOAD MANAGEMENT**
Control interfaces of generation allocation of the large interconnected power system, 3:21470
Rational utilization of medium-capacity power blocks when passing through deep lows of electric load graphs, 3:21537
**POWER SYSTEMS/MATHEMATICAL MODELS**
Voltage and reactive production programming in an electric system. II. Notes on mathematical models of generators and loads, 3:21511
**POWER SYSTEMS/OPERATION**
Control interfaces of generation allocation of the large interconnected power system, 3:21470
**POWER SYSTEMS/OPTIMIZATION**
Security constrained optimization for power systems, 3:21471
**POWER SYSTEMS/PLANNING**
Industry in national planning: the power industry (1985 and 2000$), 3:21742 (SIND-PM-1977-3)
Problems in planning and constructing transmission lines which interconnect utilities: Federal Power Commission, 3:21748 (PB-269614)
**POWER SYSTEMS/RELIABILITY**
Problems in planning and constructing transmission lines which interconnect utilities: Federal Power Commission, 3:21748 (PB-269614)
**POWER SYSTEMS/SECURITY**
Security constrained optimization for power systems, 3:21471
**POWER SYSTEMS/SIMULATION**
Simulation of the active power dynamics of parallel-circuit electrical energy supply networks, 3:21535
**POWER SYSTEMS/STABILITY**
Stability of interconnected systems, 3:21539
Transient stability criteria, 3:21538
**POWER SYSTEMS/SWITCHES**
Fast-tripping operation of the coupling bay protection in case of faults in the immediate vicinity of the busbars, 3:21536
**POWER SYSTEMS/TRANSIENTS**
Application of the statistical theory of feedback to power system identification, 3:21540
Transient stability criteria, 3:21538
**POWER TRANSMISSION**
*See also UNDERGROUND POWER TRANSMISSION*
**POWER TRANSMISSION/SUPERCONDUCTING CABLES**
LASL $Nb_3Ge$ conductor development. Eighth quarterly progress report, July 1-September 30, 1977, 3:21553 (LA-7037-PR)
**POWER TRANSMISSION LINES/BIBLIOGRAPHIES**
Environmental aspects of transmission lines: a selected, annotated bibliography, 3:21531 (ORNL/EIS-122)
**POWER TRANSMISSION LINES/CIRCUIT BREAKERS**
Modeling of arc discharges in power circuit breakers. Final report, 3:21529 (EPRI-EL-482)
**POWER TRANSMISSION LINES/CONSTRUCTION**
Environmental management during power transmission line construction: operational considerations, 3:21552

New 380 kV lines constructed by the Bayernwerk AG, 3:21551
**POWER TRANSMISSION LINES/ELECTRIC CABLES**
Energy and information transmission in 20 kV medium-voltage systems using the phase-wire cable system, 3:21534
**POWER TRANSMISSION LINES/ELECTRIC FIELDS**
ac transmission line field measurements, 3:21550 (HCP/T6010-E1)
**POWER TRANSMISSION LINES/ENVIRONMENTAL EFFECTS**
ac transmission line field measurements, 3:21550 (HCP/T6010-E1)
Ecological perspectives of power transmission, 3:21543
Environmental management during power transmission line construction: operational considerations, 3:21552
Environmental aspects of transmission lines: a selected, annotated bibliography, 3:21531 (ORNL/EIS-122)
Historical and legal aspects of transmission lines, 3:21547
Microclimate modification due to power transmission rights of way, 3:21544
Multiple use potential along power transmission rights of way, 3:21546
Power lines and the environment, 3:21542
Selective planting for the encouragement of wildlife, 3:21545
**POWER TRANSMISSION LINES/ENVIRONMENTAL IMPACT STATEMENTS**
Preparing environmental impact statements: comments based on personal experience, 3:21548
**POWER TRANSMISSION LINES/LAND USE**
Historical and legal aspects of transmission lines, 3:21547
Multiple use potential along power transmission rights of way, 3:21546
Selective planting for the encouragement of wildlife, 3:21545
**POWER TRANSMISSION LINES/LEGAL ASPECTS**
Historical and legal aspects of transmission lines, 3:21547
**POWER TRANSMISSION LINES/MAGNETIC FIELDS**
ac transmission line field measurements, 3:21550 (HCP/T6010-E1)
**POWER TRANSMISSION LINES/MEETINGS**
Power lines and the environment, 3:21542
**POWER TRANSMISSION LINES/SUPERCONDUCTING CABLES**
Picosecond pulses on superconducting striplines, 3:22007
**PRECURSORS (DELAYED PROTON)**
*See DELAYED PROTON PRECURSORS*
**PRENATAL IRRADIATION**
Some problems in radiation exposure of pregnant women, 3:22258
**PRESSURE SUPPRESSION/HYDRODYNAMICS**
Suppression pool dynamics. Quarterly progress report, April 1-June 30, 1977 (BWR), 3:21642 (NUREG-0264-4)
**PRESSURE SUPPRESSION/SIMULATION**
BWR Mark I pressure suppression study: bench mark experiments, 3:21649 (UCID-17661)
BWR Mark I pressure suppression study: effect of downcomer fill level on the vertical load function, 3:21650 (UCID-17662)
**PRESSURE VESSELS/ARC WELDING**
Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress, 3:21874 (ZJE-186)
**PRESSURE VESSELS/ELECTROSLAG WELDING**
Thermal-deformation effect of welding on A 1 reactor pressure vessel weld joints properties and state of stress, 3:21874 (ZJE-186)
**PRESSURE VESSELS/FAILURES**
Failure analysis of pressure vessels with defects. Progress report, September 1976, 3:21640 (N-77-26550)
Significance of hydraulic testing of reactor pressure vessels from the standpoint of fracture mechanics, 3:21609
**PRESSURE VESSELS/MECHANICAL PROPERTIES**
Metallurgical evolution of heavy forgings in low alloys steels for nuclear vessels (PWR; Ni-Cr-Mo steel SA 508 C 13), 3:21564
**PRESSURE VESSELS/RUPTURES**
Pressure vessel question, 3:21667
**PRESSURE VESSELS/STRESS ANALYSIS**
Significance of hydraulic testing of reactor pressure vessels from the standpoint of fracture mechanics, 3:21609
**PRESSURE VESSELS/THERMAL SHOCK**
Thermal shock studies associated with injection of emergency core coolant following a loss-of-coolant accident in PWRs, 3:21651
**PRESSURIZED WATER REACTORS**
*See PWR TYPE REACTORS*
**PRIMARY BATTERIES/CATHODES**
Electrochemical generator, 3:21675
**PRIMARY COOLANT CIRCUITS/CORROSION**
Stainless steel thick plates for light-water reactors (PWR cooling system components), 3:21565
**PRIMARY COOLANT CIRCUITS/PUMPS**
One-Third-Scale Air-Water Pump Program: test program and pump performance (BWR, PWR), 3:21637 (EPRI-NP-135)
**PRIMARY COOLANT CIRCUITS/RADIOACTIVITY TRANSPORT**
Sodium engineering and technology. Technical progress report, April, May, June 1977 (LMFBR), 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977 (LMFBR), 3:21586 (HEDL-TME-77-38)
**PRINCETON LARGE TORUS**
*See PLT DEVICES*
**PROCESS HEAT REACTORS/COAL GASIFICATION**
Electrofluid gasification of coal with nuclear energy (Process heat supplied by thermal and/or electric coupling), 3:20864
**PROCESSING (WASTES)**
*See WASTE PROCESSING*
**PROJECT INDEPENDENCE**
Project independence Evaluation System (Pies) documentation. Volume XIV. A user's guide, 3:21715 (PB-268850)
**PROMETHAZINE**
*See AMINES*
**PROMETHIUM COMPLEXES/NUCLEAR MAGNETIC RESONANCE**
Nuclear magnetic resonance study of the structure in solution of lanthanide complexes with benzene-1,2-dioxydiacetate, 3:21960
**PROPANE/ENERGY SUPPLIES**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
**PROPIONIC ACID/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**PROPIONIC ACID/LIQUID COLUMN CHROMATOGRAPHY**
Concentration and quantitative determination of trace volatile fatty acids in water by liquid chromatography with thermal detector, 3:21931 (BNWL-tr-279)
**PROTACTINIUM 223/FRANCIUM**
Nuclear data sheets for A=223, 3:22376
**PROTACTINIUM 223/NUCLEAR STRUCTURE**
Nuclear data sheets for A=223, 3:22376
**PROTACTINIUM 227/NUCLEAR STRUCTURE**
Nuclear data sheets for A=227, 3:22377
**PROTECTION (RADIATION)**
*See RADIATION PROTECTION*
**PROTEINS**
*See also FERRITIN*
*LIPOPROTEINS*
**PROTEINS/CHEMICAL BONDS**
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy (Ferric, manganous, cuprous, cupric, and vanadyl ion binding), 3:21976 (LBL-6682)
**PROTEINS/CRACKING**
Proteins as a possible source material of low molecular weight petroleum hydrocarbons, 3:21261
**PROTEOLIPIDS**
*See LIPOPROTEINS*
**PROTON REACTIONS**
Polarization of prompt muons produced at large transverse momenta (2815 GeV), 3:22331
**PROTON REACTIONS/ELASTIC SCATTERING**
Elastic scattering of 0.8-GeV protons from $^{12}C$, $^{58}Ni$, and $^{208}Pb$, 3:22354
**PROTON REACTIONS/PARTICLE PRODUCTION**
Measurement of the dihadron mass continuum in p-Be collisions and a search for narrow resonances, 3:22334
**PROTON REACTIONS/PICKUP REACTIONS**
Successive and simultaneous transfer descriptions of (p,t) reactions on $^{208}Pb$, 3:22371
**PROTON-DEUTERON INTERACTIONS/INCLUSIVE INTERACTIONS**
Diffraction dissociation of high-energy protons on hydrogen and deuterium targets, 3:22333
**PROTON-NEUTRON INTERACTIONS/DIFFERENTIAL CROSS SECTIONS**
Neutrino and antineutrino proton scattering data and the ratio of down to up quarks in the proton, 3:22330
**PROTON-PROTON INTERACTIONS/ELASTIC SCATTERING**
Measurements of the total cross-section difference and the parameter Csub(LL) in pp scattering with longitudinally polarized beam and target, 3:22335
**PROTON-PROTON INTERACTIONS/INCLUSIVE INTERACTIONS**
Diffraction dissociation of high-energy protons on hydrogen and deuterium targets, 3:22333
**PROTONS**
*See also DELAYED PROTONS*
*DIPROTONS*
**PROTONS/DIFFUSION**
Diffusion of light particles in metals, 3:22392

**PROTONS/QUARK MODEL**
Neutrino and antineutrino proton scattering data and the ratio of down to up quarks in the proton, 3:22330
**PROTOTYPE LARGE BREEDER REACTOR**
*See PLBR REACTOR*
**PSI-3105 RESONANCES/DECAY**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
Psionic matter, 3:22349
**PSI-3105 RESONANCES/G PARITY**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
**PSI-3105 RESONANCES/LEPTONIC DECAY**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
**PSI-3105 RESONANCES/PARTICLE PRODUCTION**
Psionic matter, 3:22349
**PSI-3105 RESONANCES/PARTICLE WIDTHS**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
**PSI-3695 RESONANCES/DECAY**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
Psionic matter, 3:22349
**PSI-3695 RESONANCES/G PARITY**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
**PSI-3695 RESONANCES/LEPTONIC DECAY**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
**PSI-3695 RESONANCES/PARTICLE PRODUCTION**
Psionic matter, 3:22349
**PSI-3695 RESONANCES/PARTICLE WIDTHS**
Properties of the psi resonances (Cross sections, branching ratio), 3:22339 (SLAC-PUB-1602)
**P-TYPE CONDUCTORS/LIFETIME**
Tunable-laser-induced grating dip for measuring sub-picosecond relaxation, 3:21916
**PUBLIC LANDS/GOVERNMENT POLICIES**
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress (Recommended actions), 3:21692 (PB-269803)
**PUBLIC LANDS/LAND LEASING**
Structure of the geothermal industry through 1974, 3:21426
**PUBLIC LANDS/MANAGEMENT**
Institutional barriers to geothermal energy development. A report by the Institutional Barrier Panel to the Geothermal Advisory Council, 3:21421
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress (Recommended actions), 3:21692 (PB-269803)
**PUBLIC UTILITIES/ENERGY SUPPLIES**
Electric utilities captive coal operations, 3:21741 (PB-269348)
**PUBLIC UTILITIES/REGULATIONS**
Utility rules of the Georgia Public Service Commission, effective January 1, 1976, 3:21848 (PB-269420)
**PULSED MHD GENERATORS/EFFICIENCY**
Investigation of a high-efficiency MHD generator with nonequilibrium conductivity, 3:21757
**PULSED MHD GENERATORS/NON-EQUILIBRIUM PLASMA**
Investigation of a high-efficiency MHD generator with nonequilibrium conductivity, 3:21757
**PUMPS**
*See also TURBOMACHINERY*
**PUMPS/DESIGN**
Optimizing the design and use of an air-driven water pump, 3:22004
**PUMPS/FEEDWATER**
Results of tests of a prototype of the PE-600-300-2 feedwater pump, 3:21499
**PUMPS/HYDRAULICS**
One-Third-Scale Air-Water Pump Program: test program and pump performance (BWR, PWR), 3:21637 (EPRI-NP-135)
**PUMPS/PERFORMANCE**
One-Third-Scale Air-Water Pump Program, alternate analytical pump performance data (PWR), 3:21638 (EPRI-NP-385(Vol.1))
Optimizing the design and use of an air-driven water pump, 3:22004
**PUMPS/PERFORMANCE TESTING**
One-Third-Scale Air-Water Pump Program: test program and pump performance (BWR, PWR), 3:21637 (EPRI-NP-135)
Results of tests of a prototype of the PE-600-300-2 feedwater pump, 3:21499
**PVC**
*(Polyvinyl chloride.)*
**PVC/STABILITY**
PVC-stabilizators, 3:21911
**PWR TYPE REACTORS**
*See also ALMARAZ-1 REACTOR*
*ALMARAZ-2 REACTOR*
*LOFT REACTOR*
**PWR TYPE REACTORS/BLOWDOWN**
One-Third-Scale Air-Water Pump Program, alternate analytical pump performance data, 3:21638 (EPRI-NP-385(Vol.1))
One-Third-Scale Air-Water Pump Program, LOCA and pump overspeed analyses. Final report, 3:21639 (EPRI-NP-474)
**PWR TYPE REACTORS/COOLANT CLEANUP SYSTEMS**
Chemistry of feedwater for boiling-water and pressurized-water reactors (Condensate polishing plants), 3:21558
**PWR TYPE REACTORS/FUEL CANS**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report, 3:21556 (EPRI-NP-567)
**PWR TYPE REACTORS/FUEL ELEMENTS**
Postirradiation examination results for the Irradiation Effects Test Series IE-ST-2, Rod IE-002, 3:21563 (TREE-NUREG-1177)
**PWR TYPE REACTORS/GASEOUS WASTES**
Procedures employed and future development trends for waste gas purification plants for light water reactors, 3:21624
**PWR TYPE REACTORS/LOSS OF COOLANT**
Experiment data report for semiscale Mod-1 test S-06-4 (LOFT counterpart test), 3:21645 (TREE-NUREG-1124)
Experiment data report for semiscale Mod-1 test S-28-4 (steam generator tube rupture test), 3:21647 (TREE-NUREG-1151)
One-Third-Scale Air-Water Pump Program: test program and pump performance, 3:21637 (EPRI-NP-135)
Posttest REALP4 analysis of LOFT experiment L1-3A, 3:21646 (TREE-NUREG-1137)
Quarterly technical progress report on water reactor safety programs sponsored by the Nuclear Regulatory Commission's Division of Reactor Safety Research, July-September 1977, 3:21648 (TREE-NUREG-1188)
**PWR TYPE REACTORS/PRESSURE VESSELS**
Metallurgical evolution of heavy forgings in low alloys steels for nuclear vessels, 3:21564
Pressure vessel question, 3:21667
Thermal shock studies associated with injection of emergency core coolant following a loss-of-coolant accident in PWRs, 3:21651
**PWR TYPE REACTORS/PRIMARY COOLANT CIRCUITS**
One-Third-Scale Air-Water Pump Program: test program and pump performance, 3:21637 (EPRI-NP-135)
Stainless steel thick plates for light-water reactors, 3:21565
**PWR TYPE REACTORS/PUMPS**
One-Third-Scale Air-Water Pump Program, alternate analytical pump performance data, 3:21638 (EPRI-NP-385(Vol.1))
**PWR TYPE REACTORS/RADIOACTIVE EFFLUENTS**
Procedures: Source Term Measurement Program, 3:21623 (NUREG-0384)
**PWR TYPE REACTORS/RADIOACTIVE WASTE MANAGEMENT**
Procedures employed and future development trends for waste gas purification plants for light water reactors, 3:21624
**PWR TYPE REACTORS/REACTOR COMPONENTS**
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**PWR TYPE REACTORS/REACTOR MAINTENANCE**
Availability and safety of nuclear power stations, 3:21655
**PWR TYPE REACTORS/REACTOR SAFETY**
Safety-related research and development for C-E pressurized water reactors. 1976 program summaries, 3:21634 (CENPD-258)
**PWR TYPE REACTORS/STEAM GENERATORS**
Cast channel heads in low alloy steel for PWR steam generators, 3:21567
Investigation of optimal control strategies to an integral economizer U-tube steam generator, 3:21569
Production and testing of tubes for nuclear boiler steam generators, 3:21566
**PYRIDINES/ELECTRON SPIN RESONANCE**
Electron spin resonance study of liquids during photolysis. XXII. The 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions, 3:21990
**PYRIDINES/PHOTOLYSIS**
Electron spin resonance study of liquids during photolysis. XXII. The 1-hydro-2,5-pyridinedicarboxylate anion radical in basic aqueous solutions, 3:21990
**PYRITE/CLASSIFICATION**
Prediction model for compositional changes within a coal from core data. Quarterly report, September-December 1976, 3:20891 (FE-5065-2)
**PYRITE/REMOVAL**
Desulfurization of various midwestern coals by flotation, 3:20918 (BM-RI-8262)
Fossil energy research meeting, 3:20841 (CONF-7706100-)

**PYROLYTIC CARBON/CHEMICAL VAPOR DEPOSITION**
Fundamentals on the agglomerate model and its relation to the physical properties of pyrocarbon (HTGR fuel particles), 3:21574
Transmission electron microscopy of pyrocarbon coatings, 3:21145
**PYROLYTIC CARBON/MICROSTRUCTURE**
Transmission electron microscopy of pyrocarbon coatings, 3:21145
**PYROLYTIC CARBON/PHYSICAL PROPERTIES**
Fundamentals on the agglomerate model and its relation to the physical properties of pyrocarbon (HTGR fuel particles), 3:21574
**PYROXENES/CRYSTAL STRUCTURE**
Crystal structure of synthetic proto-pyroxene $Li_{0.3}Sc_{0.3}Mg_{1.4}Si_2O_6$, 3:21455

## Q

**Q RESONANCES/DECAY**
$Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications (Rates), 3:22351
**QUARK MODEL/CHARM PARTICLES**
Production of charmed particles in weak interactions with diagonal neutral currents, 3:22345
**QUARK MODEL/CHIRAL SYMMETRY**
Chiral symmetry breaking and the quark model: unification of baryon and meson constraints (Review), 3:22352
**QUASARS/ABSORPTION SPECTRA**
Analysis of "noise" in the rich absorption-line spectra of quasars. I. Method of scrambled standard lines, 3:22300
**QUEBEC/URANIUM DEPOSITS**
Mode of uranium occurrence in a migmatitic granite terrain, Baie Johan Beetz, Quebec, 3:21114

## R

**RADIATION CHEMISTRY/RESEARCH PROGRAMS**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**RADIATION DETECTORS**
*See also BUBBLE CHAMBERS*
*DIELECTRIC TRACK DETECTORS*
*GAMMA CAMERAS*
*RADIATION MONITORS*
*SCINTILLATION COUNTERS*
*TELESCOPE COUNTERS*
**RADIATION DETECTORS/COMPARATIVE EVALUATIONS**
Methods used by HASL for ambient radon studies, 3:22166 (HASL-325)
**RADIATION DOSES/CONTROL**
As low as is reasonably achievable (ALARA) studies relative to the NWTS program, 3:21211 (Y/OWI/SUB-77/42509)
**RADIATION EXPOSURE (DOSES)**
*See RADIATION DOSES*
**RADIATION HYGIENE**
*See RADIATION PROTECTION*
**RADIATION MONITORING/AUTOMATION**
Passive environmental radon monitor, 3:22170 (HASL-325)
**RADIATION MONITORING/EDUCATION**
Radiation monitor training program at Rocky Flats, 3:22281 (RFP-2434)
**RADIATION MONITORING/REGULATORY GUIDES**
Radiological effluent and environmental monitoring for uranium mills: a regulatory viewpoint, 3:22197
**RADIATION MONITORS**
Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**RADIATION PROTECTION/EDUCATION**
Safety training as a means of reducing overexposures to radiographers, 3:22257
**RADIATION PROTECTION/RECOMMENDATIONS**
As low as is reasonably achievable (ALARA) studies relative to the NWTS program, 3:21211 (Y/OWI/SUB-77/42509)
**RADIATION SAFETY**
*See RADIATION PROTECTION*
**RADIATION SOURCES**
*(For cosmic sources of radiation see also COSMIC GAMMA SOURCES, COSMIC RADIO SOURCES, and COSMIC X-RAY SOURCES.)*
*See also ALPHA SOURCES*
*GAMMA SOURCES*
*X-RAY SOURCES*
**RADIATION SOURCES/FABRICATION**
Starting material radiation source for Moessbauer investigations of tellurium compounds (Patent), 3:21239
**RADIO GALAXIES/GAMMA RADIATION**
X-ray and gamma-ray line production by nonthermal ions (Centaurus), 3:22297 (N-77-27061)
**RADIOACTIVE AEROSOLS/BIOLOGICAL RADIATION EFFECTS**
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RADIOACTIVE AEROSOLS/ENVIRONMENTAL TRANSPORT**
Atmospheric characteristics essential for health effects modeling, 3:22181 (HASL-325)
Monte Carlo simulation of turbulent atmospheric transport: comparison with experimental data, 3:22192
**RADIOACTIVE AEROSOLS/HEALTH HAZARDS**
Atmospheric characteristics essential for health effects modeling, 3:22181 (HASL-325)
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RADIOACTIVE AEROSOLS/INHALATION**
Experimental study of the penetration of radioactive aerosols into the respiratory tract (Uranium mine aerosols), 3:22267 (ORNL-tr-4526)
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RADIOACTIVE AEROSOLS/TISSUE DISTRIBUTION**
Atmospheric characteristics essential for health effects modeling, 3:22181 (HASL-325)
Experimental study of the penetration of radioactive aerosols into the respiratory tract (Uranium mine aerosols), 3:22267 (ORNL-tr-4526)
**RADIOACTIVE BIOLOGICAL WASTES**
*See RADIOACTIVE WASTES*
**RADIOACTIVE EFFLUENTS**
*See also RADIOACTIVE WASTES*
Procedures: Source Term Measurement Program (BWR; PWR), 3:21623 (NUREG-0384)
**RADIOACTIVE EFFLUENTS/DIFFUSION**
Applicability of accepted diffusion models to near stack dose calculations, 3:22193
**RADIOACTIVE EFFLUENTS/ENVIRONMENTAL IMPACTS**
Method for comparing the relative environmental impact of effluents from nuclear and fossil power plants, 3:22196
**RADIOACTIVE EFFLUENTS/ENVIRONMENTAL TRANSPORT**
Jeremiah Environmental Computational System, 3:22194
**RADIOACTIVE EFFLUENTS/MATHEMATICAL MODELS**
ENFORM fuel cycle effluents model, 3:21204
**RADIOACTIVE EFFLUENTS/MONITORING**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**RADIOACTIVE EFFLUENTS/RADIATION MONITORING**
Radiological effluent and environmental monitoring for uranium mills: a regulatory viewpoint, 3:22197
Real-time alpha-beta-gamma environmental radiation monitoring system, 3:22122
**RADIOACTIVE EFFLUENTS/STACK DISPOSAL**
Applicability of accepted diffusion models to near stack dose calculations, 3:22193
**RADIOACTIVE MATERIALS/CLEANING**
Containment and removal of radioactive spills by depositing a crosslinked ion exchange composition in a dry form over region of spill (Patent), 3:21213
**RADIOACTIVE MATERIALS/CONTAINMENT**
Containment and removal of radioactive spills by depositing a crosslinked ion exchange composition in a dry form over region of spill (Patent), 3:21213
**RADIOACTIVE WASTE DISPOSAL**
Experimental investigations on anhydrite. Report No. 2, 3:21195 (DOE-tr-49)
Neutronic analysis of a laser-fusion-driven actinide waste burner, 3:22634
**RADIOACTIVE WASTE DISPOSAL/ENVIRONMENTAL IMPACT STATEMENTS**
Draft environmental impact statement. High-level waste repository site suitability criteria, 3:21182 (UCRL-13804)
**RADIOACTIVE WASTE DISPOSAL/GEOLOGIC DEPOSITS**
Supplemental field and literature investigation of the upper cretaceous Austin Group (chalk) of Texas with regard to its potential for radioactive-waste isolation, 3:21191 (Y/OWI/SUB-4310/4)
**RADIOACTIVE WASTE DISPOSAL/LOW-LEVEL RADIOACTIVE WASTES**
EPA activities in radioactive waste management, 3:21198

ERDA's role in low-level waste management, 3:21197
Goals and projects of U.S. Geological Survey for the study of solid low-level radioactive wastes, 3:21199
Nuclear Regulatory Commission's Low-Level Waste Management Program, 3:21196
Overview of low-level radwaste management, 3:21200
**RADIOACTIVE WASTE DISPOSAL/MILL TAILINGS**
Radiological criteria for the phase II inactive mill tailings program, 3:21207
Summary of the Phase II, Title I, engineering assessment of inactive uranium mill tailings, Gunnison Site, Gunnison, Colorado, 3:21201 (GJT-125)
**RADIOACTIVE WASTE DISPOSAL/REVIEWS**
Chemistry of nuclear waste disposal, 3:21194
Radioactive waste disposal: low and high level, 3:21174
**RADIOACTIVE WASTE DISPOSAL/UNDERGROUND DISPOSAL**
EPA activities in radioactive waste management, 3:21198
ERDA's role in low-level waste management, 3:21197
Goals and projects of U.S. Geological Survey for the study of solid low-level radioactive wastes, 3:21199
High-level and long-lived radioactive waste disposal, 3:21193
Nuclear Regulatory Commission's Low-Level Waste Management Program, 3:21196
Overview of low-level radwaste management, 3:21200
Summary of shallow land burial of radioactive wastes at commercial sites between 1962 and 1976, with projections, 3:21192
**RADIOACTIVE WASTE MANAGEMENT**
*See also RADIOACTIVE WASTE STORAGE*
Procedures employed and future development trends for waste gas purification plants for light water reactors, 3:21624
**RADIOACTIVE WASTE MANAGEMENT/FLOWSHEETS**
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**RADIOACTIVE WASTE MANAGEMENT/STABILIZATION**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
**RADIOACTIVE WASTE PROCESSING**
*See also IODOX PROCESS*
**RADIOACTIVE WASTE PROCESSING/ADSORPTION**
Use of natural Uzbekistan zeolites for purification of low-level liquid waste. I. Sorption of radioactive cesium, 3:21178
**RADIOACTIVE WASTE PROCESSING/CALCINATION**
Development of a fluidized-bed calciner and past-treatment processes for solidification of commercial fuel-reprocessing liquid wastes, 3:21170 (ICP-1136)
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**RADIOACTIVE WASTE PROCESSING/GASEOUS WASTES**
Activation of water-soluble amines by halogenes for catching radioactive iodine out of air streams (Patent), 3:21176
Recombinator of hydrogen and oxygen (Patent), 3:21177
**RADIOACTIVE WASTE PROCESSING/MILL TAILINGS**
Problems in the separation of radium from uranium ore tailings, 3:21179
**RADIOACTIVE WASTE PROCESSING/PYROLYSIS**
Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April-June 1977, 3:21172 (MLM-2463)
**RADIOACTIVE WASTE PROCESSING/REVIEWS**
Radioactive waste disposal: low and high level, 3:21174
**RADIOACTIVE WASTE PROCESSING/SOLIDIFICATION**
$SrTiO_3$ synthesis process for solidification of strontium-90, 3:21175
Studies on the thermal decomposition of nitrates found in highly active waste and of chemicals used to convert the waste to glass, 3:21168 (AERE-R-8735)
**RADIOACTIVE WASTE PROCESSING/TRANSMUTATION**
Development of an irradiation technology for the recycling of Am-241 in nuclear reactors. A contribution to the possibilities for the reduction of the hazard potential of α-bearing wastes, 3:21171 (KFK-2431)
**RADIOACTIVE WASTE STORAGE/DEMONSTRATION PROGRAMS**
Scoping report on various salt mines in the United States, 3:21184 (Y/OWI/SUB-77/16523/2)
**RADIOACTIVE WASTE STORAGE/LEAKS**
Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP-1476)
**RADIOACTIVE WASTE STORAGE/MEETINGS**
National waste terminal storage program, 3:21189 (Y/OWI/SUB-77/16537)
**RADIOACTIVE WASTE STORAGE/PILOT PLANTS**
Archaeological reconnaissance of a proposed site for the Waste Isolation Plant (WIPP), 3:21167 (SAND-77-7024)
**RADIOACTIVE WASTE STORAGE/PLANNING**
National Waste Terminal Storage Program: planning and control plan. Volume II. Plan description, 3:21185 (Y/OWI/SUB-77/16535/2)
National Waste Terminal Storage Program: configuration management plan. Volume II. Plan description, 3:21186 (Y/OWI/SUB-77/16535/4)
National Waste Terminal Storage Program: critical element management concept. Volume I. Management summary, 3:21187 (Y/OWI/SUB-77/16535/7)
National Waste Terminal Storage Program: critical element management concept. Volume II. Concept description, 3:21188 (Y/OWI/SUB-77/16535/8)
**RADIOACTIVE WASTE STORAGE/RADIATION DOSES**
As low as is reasonably achievable (ALARA) studies relative to the NWTS program, 3:21211 (Y/OWI/SUB-77/42509)
**RADIOACTIVE WASTE STORAGE/RESEARCH PROGRAMS**
Borehole cement and rock properties studies: progress report, October 1, 1976-September 30, 1977, 3:21190 (Y/OWI/SUB-4091/6)
**RADIOACTIVE WASTE STORAGE/REVIEWS**
Radioactive waste disposal: low and high level, 3:21174
**RADIOACTIVE WASTE STORAGE/SALT DEPOSITS**
National waste terminal storage program, 3:21189 (Y/OWI/SUB-77/16537)
**RADIOACTIVE WASTE STORAGE/SITE SELECTION**
Archaeological reconnaissance of a proposed site for the Waste Isolation Plant (WIPP), 3:21167 (SAND-77-7024)
Subsurface geology of a potential waste emplacement site, Salt Valley Anticline, Grand County, Utah, 3:21183 (USGS-OFR-77-761)
**RADIOACTIVE WASTE STORAGE/TANKS**
Low-pressure hydraulic technique for slurrying radioactive sludges in waste tanks, 3:21165 (DP-1468)
**RADIOACTIVE WASTE STORAGE/UNDERGROUND STORAGE**
Evaluation of hydrologic isolation from evidence in mine openings in igneous and metamorphic rocks in the Maritime Provinces of Canada, 3:21181 (ORNL/Sub-4415)
**RADIOACTIVE WASTES**
*See also OFF-GAS SYSTEMS*
*RADIOACTIVE EFFLUENTS*
**RADIOACTIVE WASTES/CONTAINERS**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**RADIOACTIVE WASTES/CORROSIVE EFFECTS**
Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP-1476)
**RADIOACTIVE WASTES/ENVIRONMENTAL TRANSPORT**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT-20)
Hanford groundwater transport estimates for hypothetical radioactive waste incidents, 3:22223 (ARH-LD-162)
**RADIOACTIVE WASTES/RADIATION MONITORING**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT-20)
Environmental radioactivity from hospitals, 3:22226
**RADIOACTIVE WASTES/WASTE TRANSPORTATION**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**RADIOAPPLICATORS**
*See RADIATION SOURCES*
**RADIOCARBON DATING**
*See CARBON 14*
**RADIODIAGNOSIS (RADIONUCLIDES)**
*See NUCLEAR MEDICINE*
**RADIOFREQUENCY SYSTEMS**
*See RF SYSTEMS*
**RADIOGRAPHY (INDUSTRIAL)**
*See INDUSTRIAL RADIOGRAPHY*
**RADIOISOTOPE HEAT SOURCES/IONIZING RADIATIONS**
RTG radiation and its effect on spacecraft instrumentation, 3:22128
**RADIOLOGICAL PERSONNEL/RADIATION PROTECTION**
Safety training as a means of reducing overexposures to radiographers, 3:22257
**RADIOMETRIC ANALYSIS/QUALITY CONTROL**
Analyses of quality control samples at EML and a contractor laboratory during 1977 (Samples of bone, food, tap water and fallout $^{90}Sr$, $^{137}Cs$), 3:22143 (EML-334)

EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**RADIOPROTECTIVE SUBSTANCES/SYNTHESIS**
Search for radioprotective agents. Part XXXIX. Synethesis of some sulfenamides, 3:22259
**RADIUM/LEACHING**
Problems in the separation of radium from uranium ore tailings, 3:21179
**RADIUM/RADIOACTIVE WASTE DISPOSAL**
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
**RADIUM 215/NUCLEAR STRUCTURE**
Nuclear data sheets for A=215, 3:22372
**RADIUM 219/NUCLEAR STRUCTURE**
Nuclear data sheets for A=219, 3:22373
**RADIUM 223/FRANCIUM**
Nuclear data sheets for A=223, 3:22376
**RADIUM 223/NUCLEAR STRUCTURE**
Nuclear data sheets for A=223, 3:22376
**RADIUM 227/NUCLEAR STRUCTURE**
Nuclear data sheets for A=227, 3:22377
**RADON/ALPHA DOSIMETRY**
Radon and daughter measurements with active and passive devices using track etch detectors, 3:22165 (HASL-325)
**RADON/CARCINOGENESIS**
Exposure to radon daughters and the incidence of lung cancer, 3:22256
**RADON/DAUGHTER PRODUCTS**
$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)
Experimental study of the penetration of radioactive aerosols into the respiratory tract (Uranium mine aerosols), 3:22267 (ORNL-tr-4526)
Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves, 3:22185 (HASL-325)
Radiation surveys in contaminated communities (Uranium contamination), 3:22179 (HASL-325)
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RADON/ENVIRONMENTAL TRANSPORT**
$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
Radon workshop, February 1977, 3:22163 (HASL-325)
**RADON/HEALTH HAZARDS**
Experimental study of the penetration of radioactive aerosols into the respiratory tract (Uranium mine aerosols), 3:22267 (ORNL-tr-4526)
**RADON/INHALATION**
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RADON/MEETINGS**
Radon workshop, February 1977, 3:22163 (HASL-325)
**RADON/RADIATION MONITORING**
$^{222}$Rn and its daughters in buildings at Uranium City, Saskatchewan, 3:22187 (HASL-325)
3R-WL air sampling survey meter (Uranium mine air monitor), 3:22171 (HASL-325)
Background working levels and the remedial action guidelines, 3:22183 (HASL-325)
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)
Comparison of errors of integrating working level devices (Radon monitoring), 3:22174 (HASL-325)
Continuous and grab sampling determinations of radon concentrations, 3:22167 (HASL-325)
Design and application of a continuous, digital-output, environmental radon measuring instrument, 3:22176 (HASL-325)
Environmental radon and thoron monitor, 3:22169 (HASL-325)
Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves, 3:22185 (HASL-325)
Methods used by HASL for ambient radon studies, 3:22166 (HASL-325)
Passive environmental radon monitor, 3:22170 (HASL-325)
Radiation surveys in contaminated communities (Uranium contamination), 3:22179 (HASL-325)
Radon and radon daughters: measurement and analysis successes and difficulties experienced by EPA, 3:22180 (HASL-325)
Radon workshop, February 1977, 3:22163 (HASL-325)
Survey of radon monitoring techniques, 3:22168 (HASL-325)
Uranium mine radon control research, 3:21216
Ventilation measurements as an adjunct to radon measurements in buildings, 3:22190 (HASL-325)
What do we sample for and for how long (Ra and daughter products monitoring), 3:22178 (HASL-325)
**RADON 215/NUCLEAR STRUCTURE**
Nuclear data sheets for A=215, 3:22372
**RADON 219/NUCLEAR STRUCTURE**
Nuclear data sheets for A=219, 3:22373
**RADON 220/RADIATION MONITORING**
Measurements of seasonal and daily radon daughter concentration fluctuations in National Park Service caves, 3:22185 (HASL-325)
**RADON 222/ENVIRONMENTAL TRANSPORT**
Application of field spectrometry to radiation studies in phosphate regions, 3:22188 (HASL-325)
Measurements of $^{222}$Rn in water and indoor airborne $^{222}$Rn originating in water, 3:22221 (HASL-325)
**RADON 222/INHALATION**
Measurements of $^{222}$Rn in water and indoor airborne $^{222}$Rn originating in water, 3:22221 (HASL-325)
**RADON 222/RADIATION MONITORING**
Application of field spectrometry to radiation studies in phosphate regions, 3:22188 (HASL-325)
Estimation of $^{222}$Rn daughter doses from large-area sources, 3:22195
Measurements of $^{222}$Rn flux with charcoal coanisters (Ground $^{222}$Rn flux measurements), 3:22200 (HASL-325)
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
Radon levels and ventilation effects in underground enclosures (Radioactivity from $^{222}$Rn in air in Workman Mine and Carlsbad Caverns), 3:22184 (HASL-325)
Some remarks on exact methods for WL and $^{222}$Rn-daughter determination (Monitoring working level radioactivity in uranium mines), 3:22172 (HASL-325)
Variation of radon and radon daughter concentrations with height above ground, 3:22177 (HASL-325)
**RAILWAYS/MANAGEMENT**
Freight car management systems: a new way out of the car utilization dilemma, 3:21802
**RARE EARTH COMPLEXES/ENTHALPY**
Thermodynamic properties of lanthanide complexes with benzene-1,2-dioxydiacetic acid, 3:21961
**RARE EARTH COMPLEXES/ENTROPY**
Thermodynamic properties of lanthanide complexes with benzene-1,2-dioxydiacetic acid, 3:21961
**RARE EARTH COMPLEXES/FREE ENERGY**
Thermodynamic properties of lanthanide complexes with benzene-1,2-dioxydiacetic acid, 3:21961
**RAYLEIGH-TAYLOR INSTABILITY/MATHEMATICAL MODELS**
Model of the Rayleigh-Taylor stability of an ablating fluid, 3:22479
**RDF**
*See REFUSE DERIVED FUELS*
**REACTOR ACCIDENTS**
*See also LOSS OF COOLANT*
*LOSS OF FLOW*
*REACTOR CORE DISRUPTION*
Reportable occurrences at nuclear reactors and their causes, 3:21654
**REACTOR ACCIDENTS/MATHEMATICAL MODELS**
Compendium of computer codes for the safety analysis of fast breeder reactors, 3:21636 (DOE/ET-0009)
**REACTOR ACCIDENTS/REVIEWS**
Review of safety-related occurrences in nuclear power plants as reported in 1976, 3:21653
**REACTOR COMPONENTS**
*See also BREEDING BLANKETS*
*FUEL ELEMENTS*
*REACTOR COOLING SYSTEMS*
**REACTOR COMPONENTS/CLEANING**
Sodium engineering and technology. Technical progress report, April, May, June 1977 (LMFBR), 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977 (LMFBR), 3:21586 (HEDL-TME-77-38)
**REACTOR COMPONENTS/PHYSICAL RADIATION EFFECTS**
Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
**REACTOR CONTROL SYSTEMS**
*(The processes and operations ensuring the control and safe running of a nuclear reactor.)*
**REACTOR CONTROL SYSTEMS/OPTIMIZATION**
Suboptimal control of a nuclear reactor using functional analysis, 3:21617
**REACTOR CONTROL THEORY**
*See REACTOR KINETICS*
**REACTOR COOLING SYSTEMS**
*See also PRIMARY COOLANT CIRCUITS*

**REACTOR COOLING SYSTEMS/CORROSION PROTECTION**
Some problems of optimization of thermal diagrams of single-loop nuclear power plants, 3:21561
**REACTOR COOLING SYSTEMS/FLOWMETERS**
Signal analysis method using cross-correlation of turbulence flow signals to determine calibration of permanent magnet sodium flowmeters, 3:21579 (CONF-771023-23)
**REACTOR COOLING SYSTEMS/INTAKE STRUCTURES**
Software documentation and user's manual for fish-impingement sampling design and estimation method computer programs, 3:22210 (ANL/ES-61)
**REACTOR COOLING SYSTEMS/OPTIMIZATION**
Some problems of optimization of thermal diagrams of single-loop nuclear power plants, 3:21561
**REACTOR COOLING SYSTEMS/PRESSURE DROP**
Assessment of two-phase pressure drop correlations for steam-water systems (Boiling water reactors), 3:21559
**REACTOR COOLING SYSTEMS/PUMPS**
Standpipe-bubbler pump level control study system design layout (Task A) W.P. 4413. Engineering memorandum No. 0153, 3:21589 (TID-27895)
**REACTOR COOLING SYSTEMS/THERMAL EFFICIENCY**
Some problems of optimization of thermal diagrams of single-loop nuclear power plants, 3:21561
**REACTOR COOLING SYSTEMS/TWO-PHASE FLOW**
Assessment of two-phase pressure drop correlations for steam-water systems (Boiling water reactors), 3:21559
**REACTOR CORE DISRUPTION/AFTER-HEAT REMOVAL**
Flow visualization in heat-generating porous media (LMFBR), 3:21644 (SAND-76-0614)
**REACTOR CORE DISRUPTION/RADIOACTIVE AEROSOLS**
Source term assessment concepts for LMFBRS: Aerosol Release and Transport (ART) Analytical Program, 3:21643 (ORNL/NUREG/TM-124)
**REACTOR FUEL ELEMENTS**
*See FUEL ELEMENTS*
**REACTOR FUELS**
*See NUCLEAR FUELS*
**REACTOR INSTRUMENTATION/DESIGN**
Instrumentation for the measurement of vibration in severe environments, such as nuclear reactors, 3:21612
**REACTOR KINETICS/CALCULATION METHODS**
Lattice physics methods. Licensing topical report (BWR), 3:21557 (NEDO-20913A)
**REACTOR KINETICS/COMPUTER CODES**
User's manual for the CDC-6600 version of AMPX, 3:22385 (SAND-77-1148)
**REACTOR LICENSING**
NRC program for the resolution of generic issues related to nuclear power plants. (Includes plans for the resolution of "unresolved safety issues" pursuant to Section 210 of the Energy Reorganization Act of 1974, as amended), 3:21594 (NUREG-0410)
**REACTOR LICENSING/GOVERNMENT POLICIES**
Water supplies and the nuclear licensing process, 3:21595 (PB-270463)
**REACTOR MAINTENANCE/RADIATION PROTECTION**
Availability and safety of nuclear power stations, 3:21655
**REACTOR MATERIALS**
*(See also specific materials.)*
*See also NUCLEAR FUELS*
**REACTOR MATERIALS/MECHANICAL PROPERTIES**
Introduction to materials consideration for LMFBR components, 3:21593
**REACTOR MATERIALS/PHYSICAL RADIATION EFFECTS**
Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
Status of materials development for molten salt reactors, 3:21587 (ORNL/TM-5920)
**REACTOR PROTECTION SYSTEMS**
Safety analysis of an HTGR plant including emergency shutdown. Appendix, Volume 2. Final report, 3:21659 (K-76-124U(R)(Vol.2))
**REACTOR PROTECTION SYSTEMS/RELIABILITY**
Microcomputer-based reactor safety system, 3:21641 (N-77-26941)
**REACTOR SAFETY**
*(Theoretical and experimental investigations of the behavior of reactor types and designs under various real or hypothetical accidents.)*
Nuclear safety problems and their consequences for the materials used, 3:21657
**REACTOR SAFETY/EDUCATION**
Instruction related to reactor safety as offered by the MIT Nuclear Engineering Department, 3:21666
Integration of nuclear reactor safety in instructional programs at RPI, 3:21663
Nuclear reactor safety education at Purdue, 3:21668
Reactor safety education at Northwestern Univeristy, 3:21664
Reactor safety in the nucelar engineering program at UCLA, 3:21665
**REACTOR SAFETY/RESEARCH PROGRAMS**
Safety-related research and development for C-E pressurized water reactors. 1976 program summaries, 3:21634 (CENPD-258)
**REACTOR SITES/SEISMOLOGY**
Special considerations for seismically active areas, 3:21669
**REACTOR SITING**
*See SITE SELECTION*
**REACTOR TECHNOLOGY/MEETINGS**
Transactions of the American Nuclear Society 1977 winter meeting held Nov. 27-Dec 2, 1977, in San Francisco, California, 3:21554
**RECYCLE (FUEL)**
*See FUEL CYCLE*
**REFRACTORIES/ION MOBILITY**
Practical reasons for investigating ion transport in high temperature insulating materials, 3:21906
**REFRIGERATING MACHINERY/WORKING FLUIDS**
Significance of the non-azeotropic binary refrigerants, when used in heat pumps and refrigeration plants, 3:21781
**REFUSE**
*See SOLID WASTES*
**REFUSE DERIVED FUELS**
*See also INDUSTRIAL WASTES*
*MUNICIPAL WASTES*
*SOLID WASTES*
*SYNTHETIC FUELS*
REFUSE DERIVED FUELS/**PRODUCTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
**RENEWABLE ENERGY SOURCES**
Agriculture and energy use in the year 2000: discussion of technological changes, 3:21716
**RESEARCH REACTORS**
*See also FFTF REACTOR*
*FRM REACTOR*
*SPR-3 REACTOR*
RESEARCH REACTORS/**REACTOR ACCIDENTS**
Reportable occurrences at nuclear reactors and their causes, 3:21654
**RESERVOIR ROCK/HYDRAULIC FRACTURING**
Question of restoration of injectivity of injection wells and problem of control of the gushing process, 3:20976
Selection of objects for exerting an effect on bottom hole zone, given a great number of dependent characteristics, 3:20967
**RESERVOIR ROCK/POROSITY**
Problem of determination of the magnitude of anomalous oil layers clogging bottom hole zones of strata, 3:20974
**RESERVOIRS (WATER)**
*See WATER RESERVOIRS*
**RESIDENTIAL SECTOR/ENERGY CONSERVATION**
Home energy savers program: a little time can save a lot of money, 3:21709 (TID-28047)
**RESIDUAL FUELS/ACTIVATION ANALYSIS**
Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**RESIDUAL FUELS/DENSITY**
Experimental investigation of the density of residual fuel oil of Tyumen deposit petroleum types, 3:21041
**RESIDUAL FUELS/ENVIRONMENTAL EFFECTS**
Fate of a bunker fuel in beach sand, 3:22211 (CONF-730386-)
**RESIDUAL FUELS/NUCLEAR REACTION ANALYSIS**
Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**RESIDUAL FUELS/PHYSICAL PROPERTIES**
Experimental investigation of the density of residual fuel oil of Tyumen deposit petroleum types, 3:21041
**RESIDUES (RADIOACTIVE)**
*See RADIOACTIVE WASTES*
**RESISTORS/DESIGN**
Symmetrical $\pi$ and T attenuators: design data for component power dissipation and resistance, 3:22079 (SAND-77-1599)
**RESONANCE PARTICLES**
*See also PSI-3105 RESONANCES*
RESONANCE PARTICLES/**PARTICLE PRODUCTION**
Measurement of the dihadron mass continuum in p-Be collisions and a search for narrow resonances, 3:22334
**RESOURCE CONSERVATION**
Public rangelands continue to deteriorate: Department of the Interior, Bureau of Land Management. Report to the Congress (Recommended actions), 3:21692 (PB-269803)
**RESOURCES**
*See also GEOTHERMAL RESOURCES*
*MINERAL RESOURCES*
RESOURCES/**EVALUATION**
Energy resources available to man, 3:21695

**RESPIRATORS/PERFORMANCE TESTING**
Quantitative respirator man-testing at Rocky Flats, 3:22010 (RFP-2433)
**RESPIRATORY EQUIPMENT**
*See RESPIRATORS*
**RESPIRATORY SYSTEM**
*See also LUNGS*
**RESPIRATORY SYSTEM/BIOLOGICAL RADIATION EFFECTS**
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RESPIRATORY SYSTEM/NEOPLASMS**
Recent advances in understanding the risk due to the inhalation of radon daughters, 3:22265 (HASL-325)
**RESPIRATORY SYSTEM/RADIONUCLIDE KINETICS**
Experimental study of the penetration of radioactive aerosols into the respiratory tract (Uranium mine aerosols), 3:22267 (ORNL-tr-4526)
**RESPIRATORY SYSTEM DISEASES**
*See also PNEUMOCONIOSES*
**RESPIRATORY SYSTEM DISEASES/MORTALITY**
Respiratory disease mortality among uranium miners as related to height, radiation, smoking, and latent period, 3:21209 (HRP-0006691)
**RETINA/PHYSICAL RADIATION EFFECTS**
Solar energy research at Sandia Laboratories with unique health and safety parameters, 3:21271 (SAND-77-1412C)
**RETORTS**
*See also CHEMICAL REACTORS*
**RETORTS/OFF-GAS SYSTEMS**
Continuous water monitor for oil-shale retort effluent, 3:21108 (UCID-17682)
**REVERSE-FIELD PINCH/REVIEWS**
Reversed-field pinch reactor (RFPR), 3:22567
**REVERSE-FIELD PINCH/THERMONUCLEAR IGNITION**
Burn stability in a reversed field pinch, 3:22470
**RF SYSTEMS/COMPARATIVE EVALUATIONS**
Radio frequency drying of papers and textiles, 3:21836
**RHENIUM ALLOYS/PHYSICAL RADIATION EFFECTS**
Fission-fragment-induced helium blistering of $^{252}$Cf-exposed surfaces, 3:22679 (DP-MS-77-47)
**RHODANATES**
*See THIOCYANATES*
**RHODANIDES**
*See THIOCYANATES*
**RHODIUM COMPLEXES/STRUCTURAL CHEMICAL ANALYSIS**
Moessbauer spectra of Np(V)-Cr(III) and Np(V)-Rh(III) complexes, 3:21962
**RIBONUCLEIC ACID**
*See RNA*
**RICHLAND FFTF REACTOR**
*See FFTF REACTOR*
**RIEMANN WAVES**
*See SHOCK WAVES*
**RISER CRACKING**
*See COAL LIQUEFACTION*
**RNA**
*(Ribonucleic acid.)*
**RNA/BIOCHEMICAL REACTION KINETICS**
Translation of the RNAs of brome mosaic virus: the monocistronic nature of RNA1 and RNA2, 3:22231
**RNA/BIOSYNTHESIS**
Stimulation of informosomal RNA synthesis in cultured Chinese hamster cells exposed to low levels of cadmium, 3:22272
**ROCK MECHANICS/MATHEMATICAL MODELS**
Dynamic models used in planning operating parameters, 3:20964
**ROCK MECHANICS/PRESSURE DEPENDENCE**
Effect of pressure variation in a stratum on hydrodynamic characteristics of neighboring strata, 3:22285
**ROCKS**
*See also IGNEOUS ROCKS*
*PHOSPHATE ROCKS*
*RESERVOIR ROCK*
**ROCKS/CHEMICAL ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**ROCKS/MECHANICAL PROPERTIES**
Design optimization in underground coal systems: Section 1. Structural parameters of coal measure rocks. Section 2. Longwall mining system strata simulator. Section 3. Design criteria for underground roof-truss support systems. Interim report, April-June 1977, 3:20916 (FE-1231-9)
**ROCKS/PHYSICAL PROPERTIES**
Observation of rock using a heating microscope, 3:21456
**ROCKS/SENSIBLE HEAT STORAGE**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem (Sensible heat storage using Caloria HT43 and mixture of gravel and sand), 3:21321 (SAN/1108-8/5)
**ROCKS/SORPTIVE PROPERTIES**
Borehole cement and rock properties studies: progress report, October 1, 1976-September 30, 1977, 3:21190 (Y/OWI/SUB-4091/6)
**ROCKS/THERMAL CONDUCTIVITY**
Geothermal studies in the MacKenzie Valley by the Earth Physics Branch, 3:21411
**ROCKY FLATS PLANT/RADIATION MONITORING**
Radiation monitor training program at Rocky Flats, 3:22281 (RFP-2434)
**ROCKY MOUNTAIN REGION/WATER RESOURCES**
Defining upper limits to groundwater development in the arid West, 3:21694
**ROCKY MOUNTAINS/COAL MINING**
Rocky Mountain Coal Mining Institute. 72nd regular meeting, 3:21725 (CONF-7606160-)
**ROTARY DRILLING**
*See also WELL DRILLING*
Investigation of the motion of a solid particle under the conditions of the rotary method of drilling, 3:20972
**ROTORS/THERMAL STRESSES**
Thermally stressed state of rotors in end seal zones of the T-100-130 turbine in steamless operating conditions, 3:21498
**ROUS SARCOMA VIRUS**
*See ONCOGENIC VIRUSES*
**RUBBERS/GRAFT-HOST REACTION**
Blood compatibility of radiation-grafted hydrogels, 3:22250
**RUBIDIUM COMPOUNDS/RADIATION SCATTERING ANALYSIS**
X-ray diffuse scattering of one-dimensional tetracyanoplatinate salts, 3:21935
**RUBY LASERS/Q-SWITCHING**
Some features of weak Q switching in a ruby laser resonator, 3:22046

## S

**SAFEGUARDS**
*See also DOMESTIC SAFEGUARDS*
*IAEA SAFEGUARDS*
Joint ERDA-NRC task force on safeguards. Final report, July 12, 1976, 3:21218 (ERDA-77-34)
Recent developments and accomplishments in safeguards education and standards for the control of nuclear materials, 3:21223
**SAFEGUARDS/PLANNING**
Safetguards planning in a plant design process, 3:21228
**SAFEGUARDS/SYSTEMS ANALYSIS**
Automated approach to nuclear facility safeguards effectiveness evaluation, 3:21231
Computerized site security monitor and response system, 3:21219 (PB-269346)
**SAFEGUARDS/TECHNOLOGY ASSESSMENT**
Performance of safeguards technology-hardware, people, systems, 3:21226
**SAFETY (NUCLEAR)**
*See RADIATION PROTECTION*
**SALMON/RESPIRATION**
Respiratory response of juvenile chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil, 3:22275 (CONF-730386-)
**SALT DEPOSITS/DISSOLUTION**
National waste terminal storage program, 3:21189 (Y/OWI/SUB-77/16537)
**SALT DEPOSITS/SHAFT EXCAVATIONS**
Scoping report on various salt mines in the United States, 3:21184 (Y/OWI/SUB-77/16523/2)
**SALT DEPOSITS/STABILITY**
Geohydrolic studies of Gulf Coast interior salt domes, 3:22283 (Y/OWI/SUB-77/16537)
**SALTON SEA GEOTHERMAL FIELD/BRINES**
Development of geothermal energy: some problems, 3:21447
**SALTON SEA GEOTHERMAL FIELD/GEOTHERMAL FLUIDS**
Development of geothermal energy: some problems, 3:21447
**SAMARIUM 150 TARGET/OXYGEN 16 REACTIONS**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**SAND/POLLUTION**
Fate of a bunker fuel in beach sand, 3:22211 (CONF-730386-)
**SAND/SENSIBLE HEAT STORAGE**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V.

Thermal storage subsystem (Sensible heat storage using Caloria HT43 and mixture of gravel and sand), 3:21321 (SAN/1108-8/5)
**SANDIA LABORATORIES/RESEARCH PROGRAMS**
Solar energy research at Sandia Laboratories with unique health and safety parameters, 3:21271 (SAND-77-1412C)
**SANDSTONES/DRILLING**
Full-scale laboratory drilling tests on sandstone and dolomite. Final report, 3:20952 (COO/4098-1)
**SAP**
*(Sintered aluminium powders.)*
**SAP/TRITIUM RECOVERY**
Recovery of tritium from solid Li-Al and sintered aluminum product (SAP) blanket materials, 3:22635
**SASKATCHEWAN/URANIUM DEPOSITS**
Changing ideas on metallogenesis of Saskatchewan's uranium deposits, 3:21113
Reconnaissance-level geochemical and radiometric exploration data from the vicinity of the Rabbit Lake uranium deposit, 3:21129
**SAVANNAH RIVER PLANT/RADIOACTIVE EFFLUENTS**
Jeremiah Environmental Computational System, 3:22194
**SAVANNAH RIVER PLANT/RADIOACTIVE WASTE STORAGE**
Low-pressure hydraulic technique for slurrying radioactive sludges in waste tanks, 3:21165 (DP-1468)
Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP-1476)
**SCANDIUM/SPECIFIC HEAT**
Low temperature heat capacity of scandium and alloys of scandium, 3:21882 (IS-T-780)
**SCANDIUM ALLOYS/SPECIFIC HEAT**
Low temperature heat capacity of scandium and alloys of scandium, 3:21882 (IS-T-780)
**SCANDIUM COMPOUNDS/LATTICE PARAMETERS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**SCANDIUM COMPOUNDS/SYNTHESIS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**SCHMEHAUSEN THTR REACTOR**
*See THTR-300 REACTOR*
**SCHOOL BUILDINGS/ENERGY CONSERVATION**
Energy conservation on campus. Volume I. Guidelines, 3:21793 (FEA/D-76/229(Vol.1))
**SCHOOL BUILDINGS/HEAT RECOVERY EQUIPMENT**
Combined heat recovery system in an indoor swimming pool of a school, 3:21794
**SCHOOL BUILDINGS/ICES**
State of the art for integrated Energy/Utility Systems, 3:21849 (PB-269684)
**SCHOOL BUILDINGS/SOLAR AIR CONDITIONING**
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SCHOOL BUILDINGS/SOLAR COOLING SYSTEMS**
Solar heating and cooling system demonstration for the School of Mechanical Engineering at Georgia Tech, 3:21351
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**SCHOOL BUILDINGS/SOLAR HEATING SYSTEMS**
Solar heating and cooling system demonstration for the School of Mechanical Engineering at Georgia Tech, 3:21351
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
Terraset: taking less from the Earth, 3:21353
**SCHOOL BUILDINGS/SOLAR SPACE HEATING**
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SCHOOL BUILDINGS/SWIMMING POOLS**
Combined heat recovery system in an indoor swimming pool of a school, 3:21794
**SCHOTTKY BARRIER DIODES/INTERFACES**
Back wall Schottky barrier solar cell with an interfacial layer, 3:21288
**SCINTIGRAPHY**
*See SCINTISCANNING*
**SCINTILLATION COUNTERS**
*See also SOLID SCINTILLATION DETECTORS*
**SCINTILLATION COUNTERS/PERFORMANCE**
Filtered detector arrays for single pulsed photon measurements above 100 keV, 3:22653 (UCRL-80314)
**SCINTILLATION COUNTERS/PERFORMANCE TESTING**
Field surveys using a portable gamma ray scintillometer, 3:21128
**SCINTILLATOR-PHOTODIODE DETECTORS/PERFORMANCE**
Scintillator-photomultiplier response to a simulated REB generated thermonuclear neutron pulse, 3:22641 (SAND-77-1592C)
**SCINTISCANNING/DISPLAY DEVICES**
Alternative displays in nuclear medicine, 3:22243
**SCRUBBERS/COST**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
**SCRUBBERS/PERFORMANCE**
Capital and operating costs of particulate control equipment for coal-fired power plants, 3:21524 (CONF-7710101-3)
**SCRUBBERS/PERFORMANCE TESTING**
TVA's 1-MW pilot plant: final report on high-velocity scrubbing and vertical duct mist elimination. Report for January-September 1976, 3:21525 (PB-269850)
**SEAS**
*See also ATLANTIC OCEAN*
*PACIFIC OCEAN*
**SEAS/WATER POLLUTION**
Interagency investigations of a persistent oil spill on the Washington Coast, 3:22270 (CONF-730386-)
**SEAS/WIND**
Growth-stage scaling model for the wind-driven sea, 3:22289
**SEAWATER/ACTIVATION ANALYSIS**
Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean, 3:21925
**SEAWATER/CHEMICAL ANALYSIS**
Review of the chemical speciation of copper in seawater, 3:22214 (RLO/2229/T1-41)
Transport and reaction of heavy metals in Alaskan fjord-estuaries. Progress report, April 1, 1976-May 31, 1977, 3:22286 (RLO/2229/T1-40)
**SEDIMENTS/ACTIVATION ANALYSIS**
Instrumental neutron activation analyses for the NURE hydrogeochemical reconnaissance survey, 3:21920
**SEDIMENTS/CHEMICAL ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**SEDIMENTS/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**SEDIMENTS/RADIONUCLIDE MIGRATION**
Radionuclide geochronology and pollution history recorded in lake sediments, 3:22227
**SEDIMENTS/SAMPLING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
**SEISMIC SURVEYS/ONE-DIMENSIONAL CALCULATIONS**
One-dimensional inversion of seismograms, 3:20947
**SEISMIC WAVES/WAVE PROPAGATION**
Mechanism of change with time of seismic wave speed (effect of water and heat), 3:21399
**SELENIUM/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**SELENIUM 80 TARGET/KRYPTON 86 REACTIONS**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**SELENIUM 82 TARGET/COMPOUND-NUCLEUS REACTIONS**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**SELENIUM ISOTOPES/LASER ISOTOPE SEPARATION**
Isotopically selective ir photodissociation of $SeF_6$, 3:21974
**SELF-CONSISTENT FIELD**
Chemical applications of molecular quantum theory, 3:21947 (LBL-6699)
**SEMICONDUCTOR LASERS/CRYSTAL DEFECTS**
(GaAl)As-GaAs heterostructure lasers: factors affecting catastrophic degradation, 3:22057
Degradation characteristics of cw lasers with specific growth defects, 3:22059
Optical studies of defects and degradation in GaAs-GaAlAs double-heterostructure laser materials, 3:22058
TEM observations of dark defects in degraded gallium arsenide heterojunction lasers, 3:22060
**SEMICONDUCTOR LASERS/CRYSTAL GROWTH**
Room-temperature visible In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/($x \leqq 1, z \sim 0.6$) heterojunction lasers, 3:22064
**SEMICONDUCTOR LASERS/DESIGN**
Discrete and distributed feedback buried heterostructure lasers, 3:22062

**SEMICONDUCTOR LASERS/ENERGY YIELD**
Single-frequency GaAs injection laser, 3:22051
**SEMICONDUCTOR LASERS/FABRICATION**
In/sub 1-x/Ga/sub x/As/sub y/P/sub 1-y/-InP double-heterostructure lasers, 3:22063
**SEMICONDUCTOR LASERS/PERFORMANCE**
Room-temperature visible In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/($x \leqq 1, z \sim 0.6$) heterojunction lasers, 3:22064
**SEMICONDUCTOR LASERS/PERFORMANCE TESTING**
Characteristics of n-GaP/sub x/As/sub 1-x/-p-Ga/sub 1-y/Al/sub y/P/sub x/As/sub 1-x/ heterojunction lasers emitting visible radiation, 3:22053
In/sub 1-x/Ga/sub x/As/sub y/P/sub 1-y/-InP double-heterostructure lasers, 3:22063
**SENSIBLE HEAT STORAGE/MATERIALS TESTING**
Analysis of thermally degraded sensible heat storage hydrocarbons, 3:21384 (SAND-77-8264)
**SERPUKHOV SYNCHROTRON/NEUTRINO BEAMS**
Neutrino beam of the Institute of High-Energy Physics. I. General description and basic characteristics, 3:22116
Neutrino beam of the Institute of High-Energy Physics. IV. Focusing device of the neutrino channel, 3:22110
**SERPUKHOV SYNCHROTRON/PROTON BEAMS**
Neutrino beam of the Institute of High-Energy Physics. II. Characteristics of the 70-GeV proton beam extracted for neutrino experiments, 3:22117
Neutrino beam of the Institute of High-Energy Physics. III. System for shaping the proton beam for the external target, 3:22109
**SEWAGE**
*See LIQUID WASTES*
**SEWAGE SLUDGE/ANAEROBIC DIGESTION**
Methane gas process and apparatus (Patent), 3:21260
**SEWAGE SLUDGE/COMBUSTION**
Pollution control by incineration, 3:21850
**SEWAGE SLUDGE/RADIOSTERILIZATION**
Recent developments in the Sandia Laboratories' sewage sludge irradiation program, 3:21240 (SAND-77-1411)
**SEWAGE TREATMENT**
*See WASTE PROCESSING*
**SHALE OIL/CHEMICAL COMPOSITION**
Oil shale retorting: Part 2, variation in product oil chemistry during retorting of an oil shale block, 3:21105 (UCRL-52256(Pt.2))
**SHALE TAR/CHEMICAL REACTION YIELD**
Thermal decomposition of kuckersite shale in vacuum, 3:21107
**SHEATHS (FUEL)**
*See FUEL CANS*
**SHIVA FACILITY/CONTROL SYSTEMS**
Automatic alignment system for the twenty beam shiva fusion laser, 3:22652 (UCRL-80249)
**SHIVA FACILITY/ENERGY BALANCE**
Energy balance measurements for Shiva, 3:22649 (UCRL-79801)
**SHIVA FACILITY/MEASURING METHODS**
Shiva optical diagnostics, 3:22645 (UCRL-79776)
**SHIVA FACILITY/OSCILLATORS**
Performance of the short-pulse oscillators for Argus and Shiva, 3:22643 (UCRL-79535)
**SHIVA FACILITY/PERFORMANCE**
Performance of the short-pulse oscillators for Argus and Shiva, 3:22643 (UCRL-79535)
**SHIVA FACILITY/TARGET CHAMBERS**
Shiva target irradiation facility, 3:22647 (UCRL-79784)
**SHOCK ABSORBERS/PERFORMANCE TESTING**
Some results of investigation of the functioning of antivibration devices, 3:20963
**SHOCK HEATING**
Heating and ionization in MHD switch-on shocks in partially ionized plasmas, 3:22408
**SHOCK WAVES/INSTABILITY**
Effects of hydrogen impurities on shock structure and stability in ionizing monatomic gases. II. Krypton, 3:22523
**SHOCK WAVES/WAVE PROPAGATION**
Heating and ionization in MHD switch-on shocks in partially ionized plasmas, 3:22408
Outer shock structure of shock-waves propagating in partially ionized gases, 3:22528
**SILICA/CRYSTAL GROWTH**
Investigation of the mechanism of fly-ash formation in coal-fired utility boilers. Quarterly report, May 1, 1977-July 31, 1977, 3:20901 (FE-2205-8)
**SILICON/ACTIVATION ANALYSIS**
Fast-neutron activation analysis in coal research, 3:21921
**SILICON/ANNEALING**
Laser annealing of boron-implanted silicon, 3:21912
**SILICON/CHEMICAL PREPARATION**
Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977-July 31, 1977, 3:21276 (ERDA/JPL/954471-77/3)
Silicon halide-alkali metal flames as a source of solar grade silicon. First quarterly report, 3:21278 (ERDA/JPL/954777-77/1)
**SILICON/CRYSTAL GROWTH**
Silicon for solar cells (74 references), 3:21292
**SILICON/CUTTING**
Slicing of silicon into sheet material. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Sixth quarterly report, June 18, 1977-September 18, 1977, 3:21274 (ERDA/JPL/954374-77/3)
**SILICON/ION IMPLANTATION**
Laser annealing of boron-implanted silicon, 3:21912
**SILICON/PRODUCTION**
Silicon on ceramic process. Silicon sheet growth development for the Large-Area Silicon Sheet Task of the Low-Cost Silicon Solar Array Project. Annual report No. 2, September 17, 1976-September 19, 1977, 3:21273 (ERDA/JPL/954356-77/3)
**SILICON/PURIFICATION**
Research and development of low-cost processes for integrated solar arrays. Semi-annual report No. 3, 1 January-30 June 1975, 3:21281 (PB-269670)
**SILICON/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**SILICON/ZONE MELTING**
Research and development of low-cost processes for integrated solar arrays. Semi-annual report No. 3, 1 January-30 June 1975, 3:21281 (PB-269670)
**SILICON CARBIDES/CHEMICAL REACTIONS**
Reactions between SiC and Pd or $CeO_2$ at high temperatures (HTGR fuel particles), 3:21576
**SILICON COMPOUNDS/LATTICE PARAMETERS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**SILICON COMPOUNDS/SYNTHESIS**
Synthesis and crystal structure of a magnesium-lithium-scandium protopyroxene, 3:21967
**SILICON FLUORIDES/CHEMICAL PREPARATION**
Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977-July 31, 1977, 3:21276 (ERDA/JPL/954471-77/3)
**SILICON FLUORIDES/REDUCTION**
Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977-July 31, 1977, 3:21276 (ERDA/JPL/954471-77/3)
**SILICON OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**SILICON SOLAR CELLS/COST**
Single crystal silicon photocells for terrestrial use: state of the art and future prospects, 3:21294
**SILICON SOLAR CELLS/COVERINGS**
Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July-September 1977, 3:21275 (ERDA/JPL/954458-77/6)
**SILICON SOLAR CELLS/CURRENT DENSITY**
Theoretical effects of surface diffused region lifetime models on silicon solar cells, 3:21285
**SILICON SOLAR CELLS/FABRICATION**
Silicon for solar cells (74 references), 3:21292
Silicon halide-alkali metal flames as a source of solar grade silicon. First quarterly report, 3:21278 (ERDA/JPL/954777-77/1)
Silicon on ceramic process. Silicon sheet growth development for the Large-Area Silicon Sheet Task of the Low-Cost Silicon Solar Array Project. Annual report No. 2, September 17, 1976-September 19, 1977, 3:21273 (ERDA/JPL/954356-77/3)
Single crystal silicon photocells for terrestrial use: state of the art and future prospects, 3:21294
Slicing of silicon into sheet material. Silicon sheet growth development for the large area silicon sheet task of the low cost silicon solar array project. Sixth quarterly report, June 18, 1977-September 18, 1977, 3:21274 (ERDA/JPL/954374-77/3)
**SILICON SOLAR CELLS/MATHEMATICAL MODELS**
Theoretical effects of surface diffused region lifetime models on silicon solar cells, 3:21285
**SILICON SOLAR CELLS/PERFORMANCE**
Silicon on ceramic process. Silicon sheet growth development for the Large-Area Silicon Sheet Task of the Low-Cost Silicon Solar Array Project. Annual report No. 2, September 17, 1976-September 19, 1977, 3:21273 (ERDA/JPL/954356-77/3)
**SILICON SOLAR CELLS/PERFORMANCE TESTING**
Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July-September 1977, 3:21275 (ERDA/JPL/954458-77/6)
**SILICON SOLAR CELLS/PHYSICAL RADIATION EFFECTS**
Radiation resistance of silicon photoconverters with built-in electrical field in the base, 3:21290

**SILICON SOLAR CELLS/SCHOTTKY EFFECT**
Back wall Schottky barrier solar cell with an interfacial layer, 3:21288
**SILICON SOLAR CELLS/USES**
Problems relative to the adaptation of photocells to terrestrial applications, 3:21296
**SILICON SOLAR CELLS/WEATHERING**
Accelerated/abbreviated test methods, study 4 of task 3 (encapsulation) of the Low-Cost Silicon Solar Array Project. Sixth quarterly progress report, July-September 1977, 3:21275 (ERDA/JPL/954458-77/6)
**SILICONES**
*See also DC RESINS*
**SILICONES/GRAFT-HOST REACTION**
Blood compatibility of radiation-grafted hydrogels, 3:22250
**SILICONES/HYDROLYSIS**
Hydrogen gas from cured RTV silicones, 3:21977 (MHSMP-77-60)
**SILICOSIS**
*See PNEUMOCONIOSES*
**SILVER/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**SILVER/ACTIVATION ANALYSIS**
Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean, 3:21925
**SILVER/PHOTOEMISSION**
Photoemission studies of clean and adsorbate covered metal surfaces using synchrotron and uv radiation sources, 3:21883 (LBL-6906)
**SILVER/SOLVATION**
Electron spin echo modulation studies of silver atom solvation and desolvation in ice matrices, 3:21993
**SILVER/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**SILVER 109 TARGET/ARGON 40 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**SILVER 111/ENERGY LEVELS**
Lifetime of the 376.7-keV level and shape coexistence in $^{111}Ag$, 3:22363
**SILVER FLUORIDES/RADIOLYSIS**
Electron spin echo modulation studies of silver atom solvation and desolvation in ice matrices (X days), 3:21993
**SIN CYCLOTRON/BEAM MONITORING**
Proposal for an experiment at SIN: dosimetry of the $\pi$E3 beam: determination of the beam components, 3:22111 (LA-tr-77-70)
**SINGLE CELL PROTEIN/PRODUCTION**
Single cell protein and other food recovery technologies from waste. Final report March-September 1976, 3:21841 (PB-270085)
**SINTERED ALUMINUM POWDERS**
*See SAP*
**SITE SELECTION/LEGAL ASPECTS**
State side of the siting equation: some case studies, 3:21621
**SITE SELECTION/WATER REQUIREMENTS**
Water supplies and the nuclear licensing process, 3:21595 (PB-270463)
**SITES (REACTOR)**
*See REACTOR SITES*
**SKELETON/CALCIUM**
Quantitation of the degree of osteoporosis by measure of total-body calcium employing neutron activation, 3:22244
**SLAGS/PHASE STUDIES**
Chemical equilibrium in ash-laden coal combustion systems (1720 to 1870°K), 3:20890 (FE-2205-7)
**SLUDGES/COMBUSTION**
Disposal of petroleum sludges, 3:21017
**SLUDGES/RECYCLING**
Sludge from paper production. Final report. Recycling of industrial wastes. Phase II, 3:21840 (BMFT-FB-T-77-08)
**SLUDGES/SOLIDIFICATION**
Method of converting oil and waste containing sludge to dry waste (Patent), 3:21005
**SLUDGES/WASTE DISPOSAL**
Disposal of petroleum sludges, 3:21017
**SLURRIES (FUEL)**
*See FUEL SLURRIES*
**SLURRY PIPELINES/ECONOMICS**
Pipeline for transportation of solids: a reality, 3:22014
**SLURRY PIPELINES/OPERATION**
Pipeline for transportation of solids: a reality, 3:22014
**SMOG/PHOTOCHEMISTRY**
Oxidant-precursor relationships during pollutant transport conditions. An outdoor smog chamber study. Final report May 1974-November 1975, 3:22147 (PB-269877)
**SOCIOLOGY**
Archaeological and historical investigations for energy facilities: a state of the art report, 3:21685 (TID-28070)
**SODIUM/NEUTRON TRANSPORT**
Calculational tool for neutron propagation in steel and sodium media for fast reactor shielding applications, 3:22389
**SODIUM/REMOVAL**
Sodium engineering and technology. Technical progress report, April, May, June 1977 (LMFBR), 3:21585 (HEDL-TME-77-37)
Sodium engineering and technology. Technical progress report, July, August, September 1977 (LMFBR), 3:21586 (HEDL-TME-77-38)
**SODIUM/TITRATION**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**SODIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**SODIUM ALLOYS/CHEMICAL PREPARATION**
Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972-31 May 1975, 3:21871 (AD-A-042253)
**SODIUM ALLOYS/PHYSICAL RADIATION EFFECTS**
Studies of $Na_2KSb$(cs) photocathodes. Technical report 1 July 1972-31 May 1975, 3:21871 (AD-A-042253)
**SODIUM CHLORIDES/CHEMICAL RADIATION EFFECTS**
Radiation effects on salt relevant to nuclear waste disposal in salt deposits ($\gamma$-rays), 3:21173
**SODIUM CHLORIDES/PHYSICAL RADIATION EFFECTS**
Radiation effects on salt relevant to nuclear waste disposal in salt deposits ($\gamma$-rays), 3:21173
**SODIUM COMPOUNDS/CRYSTAL STRUCTURE**
Neutron diffraction study of disodium dibromotetracyanoplatinate dihydrate, 3:21970
**SODIUM COMPOUNDS/EMISSION SPECTROSCOPY**
Investigations of several interference effects in high frequency plasmas of analytical importance, 3:21942 (IS-T-741)
**SODIUM COMPOUNDS/MOESSBAUER EFFECT**
Paramagnetic spin relaxation in $Cs_2NaYbCl_6$, 3:21969
**SODIUM FLUORIDES/LEACHING**
Novel duplex vapor-electrochemical method for silicon solar cells. Quarterly progress report No. 6, May 1, 1977-July 31, 1977, 3:21276 (ERDA/JPL/954471-77/3)
**SODIUM-SULFUR BATTERIES/BATTERY SEPARATORS**
High temperature battery requirements put ceramics through their paces, 3:21676
**SOILS**
*See also PERMAFROST*
**SOILS/ALPHA SPECTROSCOPY**
Preliminary assessment of the impact of radionuclides in western coal on health and environment, 3:20935 (MLM-2497(OP))
**SOILS/CHEMICAL ANALYSIS**
Cd ion activity in soils: evaluation of Cd ion-selective electrode, 3:21930
**SOILS/CHEMICAL COMPOSITION**
Natural radioactivity of some soils in landscapes of the kolochnaya forest-steppe of the Tambov region, 3:22203 (ORNL-tr-4518)
**SOILS/CONTAMINATION**
Inhalation of dust contaminated with plutonium: Possible health effects. Health considerations of proposed residential development of land contaminated with plutonium in the Denver area, 3:21210 (HRP-0006798)
Radon concentrations in contaminated and uncontaminated premises in two Ontario towns, 3:22186 (HASL-325)
Summary report of soil removal preliminary excavations. (Report No. ES-389-75-171), 3:21166 (RFP-2458)
**SOILS/EXCAVATION**
Summary report of soil removal preliminary excavations. (Report No. ES-389-75-171), 3:21166 (RFP-2458)
**SOILS/NATURAL RADIOACTIVITY**
Natural radioactivity of some soils in landscapes of the kolochnaya forest-steppe of the Tambov region, 3:22203 (ORNL-tr-4518)
**SOILS/RADIOACTIVITY**
Measurements of $^{222}Rn$ flux with charcoal coanisters (Ground $^{222}Rn$ flux measurements), 3:22200 (HASL-325)
Measuring low concentrations of plutonium and americium in earth samples, 3:22202
**SOILS/RADIONUCLIDE MIGRATION**
Evaluation of the radionuclide concentrations in soil and plants from the 1975 terrestrial survey of Bikini and Eneu Islands, 3:22201 (UCRL-51879(Pt.3))
**SOILS/THERMAL CONDUCTIVITY**
Geothermal studies in the MacKenzie Valley by the Earth Physics Branch, 3:21411
**SOLAR AIR CONDITIONERS/DEMONSTRATION PROGRAMS**
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)

**SOLAR AIR CONDITIONERS/ECONOMICS**
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SOLAR AIR CONDITIONERS/PERFORMANCE**
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SOLAR AIR HEATERS/DESIGN**
Capturing solar energy in frontages (Hybrid window; solar air heater with glass absorber plate with 50% absorptivity), 3:21332 (NP-22447)
**SOLAR CELL ARRAYS/DESIGN**
Economical photovoltaic power generation with heat recovery, 3:21291
**SOLAR CELL ARRAYS/HEAT RECOVERY**
Economical photovoltaic power generation with heat recovery, 3:21291
**SOLAR CELL ARRAYS/SOLAR TRACKING**
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster, 3:21279 (N-77-26222)
**SOLAR CELLS**
*See also CADMIUM SULFIDE SOLAR CELLS*
*CADMIUM TELLURIDE SOLAR CELLS*
*GALLIUM ARSENIDE SOLAR CELLS*
*SILICON SOLAR CELLS*
**SOLAR CELLS/COST**
Relative cost-performance of various solar-based power supply packages, 3:21298
**SOLAR CELLS/DESIGN**
Efficiency of grating solar cells, 3:21283
**SOLAR CELLS/EFFICIENCY**
Efficiency of grating solar cells, 3:21283
Model calculations for metal-insulator-semiconductor solar cells, 3:21284
**SOLAR CELLS/FABRICATION**
Development of low-cost, high energy-per-unit-area solar cell modules. Quarterly report No. 3, July 1, 1977-September 30, 1977, 3:21277 (ERDA/JPL/954605-77/3)
**SOLAR CELLS/MARKET**
Near-term prospectives for photovoltaic solar energy conversion, 3:21299
**SOLAR CELLS/MATHEMATICAL MODELS**
Model calculations for metal-insulator-semiconductor solar cells, 3:21284
**SOLAR CELLS/PERFORMANCE**
Minority carrier MIS solar cell, 3:21289
Relative cost-performance of various solar-based power supply packages, 3:21298
**SOLAR CELLS/SEMICONDUCTOR JUNCTIONS**
Structures of photocells: homojunctions, heterostructures or heterojunctions, 3:21293
**SOLAR CELLS/SOLAR CONCENTRATORS**
General considerations concerning simple concentrators for photovoltaic cells, 3:21295
**SOLAR CELLS/USES**
Examples of applications of RTC terrestrial solar units from 1961 to 1977, 3:21297
Problems relative to the adaptation of photocells to terrestrial applications, 3:21296
**SOLAR COLLECTORS**
*See also CONCENTRATING COLLECTORS*
*FLAT PLATE COLLECTORS*
**SOLAR COLLECTORS/MATERIALS**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR-77-1314)
**SOLAR COLLECTORS/PERFORMANCE TESTING**
Economic trade-offs between the performance of collector thermal performance tests on a solar simulator as opposed to outdoor testing, 3:21270
Evaluation of initial collector field performance at the Langley Solar Building Test Facility, 3:21370 (N-77-26617)
**SOLAR CONCENTRATORS**
*See also COMPOUND PARABOLIC CONCENTRATORS*
*FRESNEL LENS*
*SOLAR REFLECTORS*
General considerations concerning simple concentrators for photovoltaic cells, 3:21295
**SOLAR CONCENTRATORS/DESIGN**
Analyzing multifacet concentrating systems, 3:21374
Concentrating heliostat array for industrial applications, 3:21383
**SOLAR CONCENTRATORS/HAZARDS**
Solar energy research at Sandia Laboratories with unique health and safety parameters, 3:21271 (SAND-77-1412C)
**SOLAR CONCENTRATORS/MATERIALS**
Investigating the geometric quality of cast polyurethane-foam duplicates for solar-energy concentrators, 3:21373
**SOLAR CONCENTRATORS/OPTICAL PROPERTIES**
Analyzing multifacet concentrating systems, 3:21374
Investigating the geometric quality of cast polyurethane-foam duplicates for solar-energy concentrators, 3:21373
**SOLAR CONCENTRATORS/OPTICS**
Concentration of diffuse radiation, 3:21372
**SOLAR CONCENTRATORS/PERFORMANCE**
Analytical and experimental study of total internal reflection prismatic panels for solar energy concentrators, 3:21381
**SOLAR CONCENTRATORS/PRISMS**
Analytical and experimental study of total internal reflection prismatic panels for solar energy concentrators, 3:21381
**SOLAR CONCENTRATORS/SOLAR REFLECTORS**
Analytical and experimental study of total internal reflection prismatic panels for solar energy concentrators, 3:21381
**SOLAR COOLING SYSTEMS**
*See SOLAR AIR CONDITIONERS*
Analysis of a solar powered residential cooling and heating system, 3:21355
**SOLAR COOLING SYSTEMS/DEMONSTRATION PROGRAMS**
Florida residential demonstration, 3:21337
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**SOLAR COOLING SYSTEMS/DESIGN**
Integrated 100% solar heated and cooled house using multi-stage air collectors, 3:21359
Kuwait solar heated and cooled home, 3:21344
Residential solar heating in Uzbekistan, 3:21335
Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
Solar heating and cooling system demonstration for the School of Mechanical Engineering at Georgia Tech, 3:21351
**SOLAR COOLING SYSTEMS/MATERIALS**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR-77-1314)
**SOLAR COOLING SYSTEMS/RESEARCH PROGRAMS**
Solar heating and cooling technical data and systems analysis. Progress report, October 1974-30 April 1977, 3:21330 (N-77-26611)
**SOLAR COOLING SYSTEMS/RETROFITTING**
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**SOLAR COOLING SYSTEMS/TECHNOLOGY TRANSFER**
CCMS solar energy pilot study. Solar heating and cooling systems in buildings, 3:21333 (UMD-4908-10)
**SOLAR COOLING SYSTEMS/THERMAL ANALYSIS**
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**SOLAR CORONA/EXTREME ULTRAVIOLET RADIATION**
On three-dimensional reconstruction of optically thin solar emission sources, 3:22299 (N-77-27056)
**SOLAR DRYERS/DESIGN**
Solar energy: soybean drying facility (Jan 1977) (Engineering Materials) (55 drawings), 3:21362 (CAPE-2607)
**SOLAR ENERGY/PASSIVE SOLAR HEATING SYSTEMS**
Heat emission of windows, exposed to the Sun, 3:21334
**SOLAR ENERGY/RESEARCH PROGRAMS**
Solar energy research at Sandia Laboratories with unique health and safety parameters, 3:21271 (SAND-77-1412C)
**SOLAR ENERGY/REVIEWS**
Solar energy for everybody. Solar cells, solar collectors with instructions for own experiments (Book), 3:21272
**SOLAR ENERGY CONVERSION/HYDROGEN PRODUCTION**
Evaluation of the photochemical production of hydrogen from solar energy, 3:21313 (UCID-17535)
**SOLAR ENERGY CONVERSION/PHOTOCHEMICAL REACTIONS**
Biomimetic approach to solar energy conversion, 3:21308 (CONF-770582-1)
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
**SOLAR ENERGY CONVERSION/REVIEWS**
Solar energy for everybody. Solar cells, solar collectors with instructions for own experiments (Book), 3:21272
**SOLAR FLARES/ENVIRONMENTAL EFFECTS**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**SOLAR HEATING/HEAT STORAGE**
Regulatory constraints on solar energy and thermal-storage installations, 3:21746
**SOLAR HEATING SYSTEMS**
*See also PASSIVE SOLAR HEATING SYSTEMS*
Analysis of a solar powered residential cooling and heating system, 3:21355
Solar powered anaerobic wastewater treatment plant, 3:21361

**SOLAR HEATING SYSTEMS/DEMONSTRATION PROGRAMS**
Florida residential demonstration, 3:21337
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SOLAR HEATING SYSTEMS/DESIGN**
Design, installation and testing of the HUD solar home in Dacula, Georgia, 3:21347
Design and installation of the HUD solar home in Shenandoah, Georgia, 3:21346
Design and installation of hydronic solar systems for three cycle-two HUD housing units in Georgia, 3:21348
Design of a solar heated energy conservation house for western Canada, 3:21352
Installation of a commercially-available pre-packaged hydronic solar heating system by a homeowner, 3:21349
Installation and operation of solar heating system for the Hooker Barnes solar home, 3:21350
Integrated 100% solar heated and cooled house using multi-stage air collectors, 3:21359
Integrating solar heating and off peak electricity usage, 3:21358
Kuwait solar heated and cooled home, 3:21344
Residential solar heating in Uzbekistan, 3:21335
Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
Solar heating and cooling system demonstration for the School of Mechanical Engineering at Georgia Tech, 3:21351
System performance of first commercial solar installation in Orange, Virginia (retrofitted office building), 3:21343
Terraset: taking less from the Earth, 3:21353
Unique solar residence uses conventional construction techniques, 3:21340
**SOLAR HEATING SYSTEMS/ECONOMICS**
First year's operation: residential solar retrofit, 3:21339
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SOLAR HEATING SYSTEMS/FEASIBILITY STUDIES**
Possibilities of solar space heating (In German Federal Republic), 3:21328 (AED-Conf-1977-053-004)
**SOLAR HEATING SYSTEMS/MATERIALS**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR-77-1314)
**SOLAR HEATING SYSTEMS/MONITORING**
Typical Mathew Solar House: a three-year report, 3:21336
**SOLAR HEATING SYSTEMS/PERFORMANCE**
Improving the performance of a solar energy heating system, 3:21356
Installation and testing of a solar heating system for an aquatic recreational facility, 3:21345
Preliminary performance data on a solar heated house (Model 24-31-B SH), 3:21341
Solar heating of the inaugural stand, 1977, 3:21338
Timonium Elementary School solar energy heating and cooling augmentation experiment. Final engineering report: executive summary (ER-8877), 3:21329 (COO/2627-2)
**SOLAR HEATING SYSTEMS/RESEARCH PROGRAMS**
Capturing solar energy in frontages (Hybrid window; solar air heater with glass absorber plate with 50% absorptivity), 3:21332 (NP-22447)
Solar heating and cooling technical data and systems analysis. Progress report, October 1974-30 April 1977, 3:21330 (N-77-26611)
**SOLAR HEATING SYSTEMS/RETROFITTING**
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**SOLAR HEATING SYSTEMS/TECHNOLOGY TRANSFER**
CCMS solar energy pilot study. Solar heating and cooling systems in buildings, 3:21333 (UMD-4908-10)
**SOLAR HEATING SYSTEMS/THERMAL ANALYSIS**
Solar heating and cooling of the El Camino Real Elementary School in Irvine, California (a retrofit ERDA demonstration project), 3:21357
**SOLAR POWER PLANTS**
*See also SOLAR THERMAL POWER PLANTS*
Development of a total energy system for the Cedar Gap Christian Retreat Center (Combination of hydroelectric units on streams, wind generators, and solar thermal power plant with wood-burning boiler backup), 3:21707
**SOLAR POWER PLANTS/ENERGY STORAGE**
Simulation algorithms and their realization by digital computer for calculation of wind- and solar-plant storage-service capacity, 3:21670
**SOLAR POWER PLANTS/NET ENERGY**
Dynamical analysis of processes substituting fossil energy, 3:21599
**SOLAR POWER PLANTS/THERMIONIC CONVERSION**
Some problems involved in the development of a solar thermionic power plant, 3:21301
**SOLAR PROCESS HEAT/FEASIBILITY STUDIES**
Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10, 3:21360 (SAN/1220-1)
**SOLAR PROCESS HEAT/TOTAL ENERGY SYSTEMS**
Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report (24 facilities in 6 industry groups), 3:21325 (SAN/1132-2/4)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21323 (ALO/3987-1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21324 (ALO/3987-1/3)
**SOLAR REFLECTORS**
*See also PARABOLIC REFLECTORS*
**SOLAR REFLECTORS/COATINGS**
Augmented solar energy collection using different types of planar reflective surfaces; theoretical calculations and experimental results, 3:21378
**SOLAR REFLECTORS/DESIGN**
Design of flat reflector-collector combinations, 3:21377
**SOLAR REFLECTORS/PERFORMANCE**
Analytical and experimental study of total internal reflection prismatic panels for solar energy concentrators, 3:21381
Measurements on the effect of planar reflectors on the flux received by flat-plate collectors, 3:21379
**SOLAR REFRIGERATORS/DESIGN**
Investigation of solar absorption cooler for round-the-clock operation, 3:21366
**SOLAR REFRIGERATORS/OPERATION**
Investigation of solar absorption cooler for round-the-clock operation, 3:21366
**SOLAR REFRIGERATORS/PERFORMANCE TESTING**
Investigation of solar absorption cooler for round-the-clock operation, 3:21366
**SOLAR SIMULATORS/COMPARATIVE EVALUATIONS**
Economic trade-offs between the performance of collector thermal performance tests on a solar simulator as opposed to outdoor testing, 3:21270
**SOLAR SIMULATORS/OPERATION**
Economic trade-offs between the performance of collector thermal performance tests on a solar simulator as opposed to outdoor testing, 3:21270
**SOLAR SPACE HEATING/TOTAL ENERGY SYSTEMS**
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21323 (ALO/3987-1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21324 (ALO/3987-1/3)
**SOLAR THERMAL POWER PLANTS/TOTAL ENERGY SYSTEMS**
Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report (24 facilities in 6 industry groups), 3:21325 (SAN/1132-2/4)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21323 (ALO/3987-1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21324 (ALO/3987-1/3)
**SOLAR TRACKING/CONTROL SYSTEMS**
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster, 3:21279 (N-77-26222)
**SOLAR WATER HEATERS**
Analysis of a solar powered residential cooling and heating system, 3:21355
Florida residential demonstration, 3:21337
Installation and testing of a solar heating system for an aquatic recreational facility, 3:21345
Solar energy evaluation, Naval Regional Medical Center, Orlando, Florida, 3:21354
**SOLAR WATER HEATERS/BOILERS**
Development and testing of solar water-heated boilers fabricated by diffusion welding, 3:21363

**SOLAR WATER HEATERS/DESIGN**
Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10, 3:21360 (SAN/1220-1)
Further development of the reinforced pillow solar water heater, 3:21365
Installation of a commercially-available pre-packaged hydronic solar heating system by a homeowner, 3:21349
Kuwait solar heated and cooled home, 3:21344
Residential solar heating in Uzbekistan, 3:21335
**SOLAR WATER HEATERS/ECONOMICS**
Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10, 3:21360 (SAN/1220-1)
**SOLAR WATER HEATERS/FEASIBILITY STUDIES**
Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10, 3:21360 (SAN/1220-1)
**SOLAR WATER HEATERS/PIPES**
Appropriate plumbing for open solar water heaters, 3:21364
**SOLID SCINTILLATION DETECTORS/DESIGN**
Background effects in scintillation counter telescopes in the upper atmosphere, 3:22125
**SOLID SCINTILLATION DETECTORS/PROTON REACTIONS**
Calculation of radioactivity induced in scintillator materials during spaceflight, 3:22293
**SOLID SCINTILLATION DETECTORS/RADIOACTIVITY**
Calculation of radioactivity induced in scintillator materials during spaceflight, 3:22293
**SOLID STATE LASERS/COLOR CENTERS**
Tunable laser via $F^{+}_{2}$ and $F^{-}_{2}$ colour centers in the spectral region 0.88-1.25 μm, 3:22039
**SOLID WASTES**
*See also AGRICULTURAL WASTES*
*MILL TAILINGS*
*REFUSE DERIVED FUELS*
*WOOD WASTES*
**SOLID WASTES/FLUIDIZED-BED COMBUSTION**
Fluidize to maximize, 3:22086
**SOLID WASTES/WASTE MANAGEMENT**
Single cell protein and other food recovery technologies from waste. Final report March-September 1976, 3:21841 (PB-270085)
**SOLID WASTES/WASTE PROCESSING**
Laundering of oil base mud cuttings (Patent), 3:21006
**SOLIDS/TRANSPORT**
Pipeline for transportation of solids: a reality, 3:22014
**SOLITONS/CYCLOTRON FREQUENCY**
High-frequency diamagnetism and three-dimensional cyclotron solitons in a plasma, 3:22529
Solitary electrostatic ion cyclotron waves, 3:22522
**SOLITONS/HYBRID RESONANCE**
Formation of upper-hybrid solitons, 3:22517
**SOLITONS/THREE-DIMENSIONAL CALCULATIONS**
High-frequency diamagnetism and three-dimensional cyclotron solitons in a plasma, 3:22529
**SOLITONS/WAVE PROPAGATION**
Solitary electrostatic ion cyclotron waves, 3:22522
**SOLVENT EXTRACTION/REVIEWS**
Solvent extraction in the nuclear industry, 3:21155
**SOLVENT-REFINED COAL/ACTIVATION ANALYSIS**
Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**SOLVENT-REFINED COAL/DEASHING**
Application of Lummus antisolvent deashing technology to a solvent refined coal solution. Final report, 3:20876 (EPRI-AF-234)
**SOLVENT-REFINED COAL/NUCLEAR REACTION ANALYSIS**
Application of nuclear techniques to the characterization of trace elements in petroleum and coal conversion products, 3:21923
**SOUTH AFRICA/COAL GASIFICATION**
Coal gasification and South Africa, 3:20865
**SOUTH AUSTRALIA/NATURAL GAS DEPOSITS**
Caroline carbon dioxide field and associated carbon dioxide occurrences, gambier embayment, south australia, 3:21063
**SOUTH CAROLINA/URANIUM DEPOSITS**
Savannah River Laboratory Hydrogeochemical and Stream Sediment Reconnaissance. Preliminary raw data release: Spartanburg $1^{\circ}$ x $2^{\circ}$ NTMS area, North Carolina and South Carolina. National Uranium Resource Evaluation Program, 3:21118 (DPST-77-146-2)
**SOVIET UNION**
*See USSR*
**SOYBEANS/SOLAR DRYING**
Solar energy: soybean drying facility (Jan 1977) (Engineering Materials) (55 drawings), 3:21362 (CAPE-2607)
**SPACE HEATERS/CONSTRUCTION**
Electric pipe heater (Patent), 3:21778
**SPACE LATTICES**
*See CRYSTAL LATTICES*
**SPACE POWER REACTORS**
Voyager: running a planetary post pattern, 3:21633
**SPACE VEHICLES/ELECTRONIC EQUIPMENT**
RTG radiation and its effect on spacecraft instrumentation, 3:22128
**SPACE VEHICLES/RADIOACTIVITY**
Induced radiations in spacecraft as background to gamma/x-ray measurements, 3:22292
**SPACE VEHICLES/SOLID SCINTILLATION DETECTORS**
Calculation of radioactivity induced in scintillator materials during spaceflight, 3:22293
**SPACECRAFT POWER SUPPLIES**
Voyager: running a planetary post pattern, 3:21633
**SPACECRAFT POWER SUPPLIES/NICKEL-CADMIUM BATTERIES**
Towards long-lived satellites, 3:21674
**SPACECRAFT POWER SUPPLIES/NICKEL-HYDROGEN BATTERIES**
Towards long-lived satellites, 3:21674
**SPARK GAPS/DESIGN**
High repetition rate spark gap. Final report, 3:22080 (UCRL-13718)
**SPARK IGNITION ENGINES/EXHAUST GASES**
Investigative study of engine limiting, 3:21860 (BERC/RI-77/13)
**SPARK IGNITION ENGINES/FUEL CONSUMPTION**
Energy usage and other comparisons between gasoline and diesel medium duty trucks, 3:21852
**SPARK IGNITION ENGINES/FUEL ECONOMY**
Investigative study of engine limiting, 3:21860 (BERC/RI-77/13)
**SPARK IGNITION ENGINES/TECHNOLOGY ASSESSMENT**
Internal combustion piston engines, 3:21846 (ANL/CES/TE-77-1)
**SPECTRALLY SELECTIVE SURFACES/ABSORPTIVITY**
Selective absorption properties of lead sulfide-aluminum coatings as a function of lead sulfide thickness, 3:21371
**SPECTROSCOPY**
*See also EMISSION SPECTROSCOPY*
**SPECTROSCOPY/TIME RESOLUTION**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**SPENT FUEL CASKS/DESIGN**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**SPENT FUEL CASKS/SAFETY**
Shipments of nuclear fuel and waste: are they really safe, 3:21162 (DOE/EV-0004)
**SPENT FUEL ELEMENTS/HEAD END PROCESSES**
Preliminary maintainability analysis of the HTGR dry head-end reprocessing systems, 3:21151 (GA-A-14678)
**SPENT FUELS/REPROCESSING**
Advanced fuel recycle program progress report, July 1-September 30, 1977, 3:21153 (ORNL/TM-6092)
Fuel elements for nuclear reactors from the cased chemical plant. High safety requirements on the reprocessing plant, 3:21160
Investigation of special resins for the extraction-chromatogaphic separation of Np and Pu from the process stream of a reprocessing plant for HTR fuel elements, 3:21158 (GERHTR-181)
Technical Division quarterly progess report, July 1-September 30, 1977, 3:21169 (ICP-1132)
**SPENT FUELS/SOLVENT EXTRACTION**
Method for increasing the lifetime of an extraction medium used for reprocessing spent nuclear fuel and/or breeder materials (Patent), 3:21154
**SPERMATOZOA/CHROMOSOMAL ABERRATIONS**
Improved mutagen-testing systems in mice. Progress report, 1 June 1976-31 August 1977, 3:22238 (COO-3267-15)
**SPONTANEOUS FISSION/REVIEWS**
Spontaneously fissioning isomers, 3:22375
**SPR-3 REACTOR/REACTOR OPERATION**
Recent operational history of the new Sandia Pulsed Reactor III (SPR III), 3:21625 (SAND-77-1116C)
**SPRINGS**
*(Mechanical springs only.)*
**SPRINGS/MECHANICAL PROPERTIES**
Coal gasification valves, Phase II. Quarterly technical progress report, June 1977-August 1977 (High temperature), 3:20856 (FE-2355-2(Rev.D))
**SQUID DEVICES/FABRICATION**
Fabrication and properties of high-temperature weak links and SQUID's, 3:22008
**SR-OB REACTOR**
*See SUBCRITICAL ASSEMBLIES*
**STAINLESS STEEL-304/PHYSICAL RADIATION EFFECTS**
Microstructure of high-dose multiple energy $He^{+}$ implanted stainless steel, 3:21899
Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA-1252)

**STAINLESS STEEL-316/PHYSICAL RADIATION EFFECTS**
HEDL magnetic fusion energy programs. Progress report, April-June 1977, 3:22681 (HEDL-TME-77-81)
Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA-1252)
**STAINLESS STEEL-316/THERMAL EXPANSION**
Alloy evaluation for fossil fuel process plants (liquefaction). Annual report, 1 October 1976-30 September 1977, 3:20879 (IS-4310)
Alloy evaluation for fossil fuel process plants (liquefaction). Quarterly report, 1 April-30 June 1977, 3:20880 (IS-4311)
**STAINLESS STEEL-321/PHYSICAL RADIATION EFFECTS**
Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA-1252)
**STAINLESS STEELS**
*See also STAINLESS STEEL-304*
*STAINLESS STEEL-316*
*STAINLESS STEEL-321*
**STAINLESS STEELS/CORROSION**
Stainless steel thick plates for light-water reactors (PWR cooling system components), 3:21565
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STAINLESS STEELS/CORROSION RESISTANCE**
Operating experience with amine absorber level control valves, 3:21076 (CONF-7603113-)
**STAINLESS STEELS/IRRADIATION PROCEDURES**
DT fusion neutron irradiation of LLL stainless steel tensile specimens at 450°C, 3:21894 (UCID-17665)
**STAINLESS STEELS/PHYSICAL PROPERTIES**
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STAINLESS STEELS/PHYSICAL RADIATION EFFECTS**
DT fusion neutron irradiation of LLL stainless steel tensile specimens at 450°C, 3:21894 (UCID-17665)
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STAINLESS STEELS/THERMAL STRESSES**
Thermal responses of tokamak reactor first walls during cyclic plasma burns, 3:22577 (CONF-771029-189)
**STAINLESS STEELS/WELDING**
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STANDING CROP**
*See BIOMASS*
**STATE GOVERNMENT/ENERGY POLICY**
Energy information and analytic system for New York State, 3:21679 (BNL-22677)
**STATIONARY POLLUTANT SOURCES**
*(Used for general articles when sources are not named. See also specific stationary sources, e.g., Fossil-fuel Power Plants.)*
*See also AIR POLLUTION*
**STATIONARY POLLUTANT SOURCES/MONITORING**
Regional air pollution study. point source emission inventory. Final report, 3:22146 (PB-269567)
**STATISTICS/ALGORITHMS**
Computer methods for sampling from student's t distribution, 3:22695
**STEAM/THERMODYNAMIC PROPERTIES**
Equation of state of water and steam for computer aided calculation of processes and equipment of power plants, 3:21500
**STEAM GENERATORS/CONTROL**
Investigation of optimal control strategies to an integral economizer U-tube steam generator (PWR), 3:21569
**STEAM GENERATORS/CORROSION**
Mechanism of corrosion of waterwalls when burning oil of high sulfur content, 3:21468
**STEAM GENERATORS/DESIGN**
Design analysis of thermal and hydrodynamic characteristics of a vertical once-through steam generator with the unit capacity of 500 MW (el.), 3:21488
**STEAM GENERATORS/FABRICATION**
Cast channel heads in low alloy steel for PWR steam generators, 3:21567
**STEAM GENERATORS/FUEL SUBSTITUTION**
Principal aspects of converting steam generators back to coal, 3:21810 (CONF-770658-)
**STEAM GENERATORS/FURNACES**
Optimalizing control of firing conditions in the furnace of drum-type steam generators, 3:21509
**STEAM GENERATORS/HYDRODYNAMICS**
Investigation of the hydrodynamics of two-phase flow with nonuniform supply of vapor over the cross section, 3:21515
**STEAM GENERATORS/PERFORMANCE**
Dynamic characteristics of the P-49 steam generator for a 500 MW power block, 3:21489
General Motors powdered coal-oil project, 3:20925 (CONF-770658-)
**STEAM GENERATORS/RUPTURES**
Experiment data report for semiscale Mod-1 test S-28-4 (steam generator tube rupture test), 3:21647 (TREE-NUREG-1151)
**STEAM GENERATORS/SUPERHEATERS**
Improvement of the reliability of waterwall superheater of the tpp-110 steam generators, 3:21508
**STEAM GENERATORS/TUBES**
Production and testing of tubes for nuclear boiler steam generators (PWR), 3:21566
**STEAM GENERATORS/TWO-PHASE FLOW**
Investigation of the hydrodynamics of two-phase flow with nonuniform supply of vapor over the cross section, 3:21515
**STEAM LINES/CORROSION**
Concerning a relation in piston compressor thermodynamics, 3:21560
**STEAM SUPERHEATERS**
*See SUPERHEATERS*
**STEAM TURBINES/COMPUTER-AIDED DESIGN**
Equation of state of water and steam for computer aided calculation of processes and equipment of power plants, 3:21500
**STEAM TURBINES/EFFICIENCY**
Effect of regeneration steam bleeding on economic efficiency of low-pressure steam turbine stages, 3:22087
Investigation of the efficiency of the low pressure cylinder of the K-200-130 turbine manufactured by the Leningrad Metal Works prior to and after modernization, 3:21497
**STEAM TURBINES/FAILURES**
Possibilities of early detection of failures in steam turbines by evaluating the temperature transmitting behavior of component groups and its correlation with defective variations (In German), 3:21486 (NP-22768)
**STEAM TURBINES/HYDRAULIC CONTROL DEVICES**
Control system of the T-250/300-240 steam turbine, 3:21502
**STEAM TURBINES/MATHEMATICAL MODELS**
Determination on a static model of the stiffness factor of the transverse circulation force in steam turbines, 3:21506
**STEAM TURBINES/OPERATION**
Investigation of conditions of operation of low-pressure sections of T-50-130 turbines with reduced ventilation steam passes, 3:21510
**STEAM TURBINES/PERFORMANCE TESTING**
Results of thermal tests of the prototype of the type t-250/322-240 turbine set made by the urals turbomachinery plant, 3:21501
**STEAM TURBINES/RELIABILITY**
Experience of operation of saturated steam turbines of nuclear power plants, 3:21611
**STEAM TURBINES/ROTORS**
Thermally stressed state of rotors in end seal zones of the T-100-130 turbine in steamless operating conditions, 3:21498
**STEAM TURBINES/TEMPERATURE MEASUREMENT**
Possibilities of early detection of failures in steam turbines by evaluating the temperature transmitting behavior of component groups and its correlation with defective variations (In German), 3:21486 (NP-22768)
**STEAM TURBINES/TURBINE BLADES**
Analysis of nonstationary processes in saturated steam turbine flow-through sections, 3:21503
Determination on a static model of the stiffness factor of the transverse circulation force in steam turbines, 3:21506
Formation of coarsely dispersed moisture on the trailing edges of nozzle rings of saturated steam turbines, 3:21504
**STEAM-IRON PROCESS/DEMONSTRATION PROGRAMS**
Development of the steam-iron process for hydrogen production. Project 9010 monthly status report, September 1-30, 1977, 3:21253 (FE-2435-19)
**STEELS**
*See also CARBON STEELS*
*CHROMIUM STEELS*
*CHROMIUM-MOLYBDENUM STEELS*
*NICKEL STEELS*
*NICKEL-CHROMIUM STEELS*
*STAINLESS STEELS*
**STEELS/CORROSION**
Corrosion control in gas processing plants which remove both $CO_2$ and $H_2S$, 3:21068 (CONF-7603113-)
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STEELS/CORROSION RESISTANCE**
Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP-1476)
**STEELS/FABRICATION**
Cast channel heads in low alloy steel for PWR steam generators, 3:21567

**STEELS/FRACTURE PROPERTIES**
Failure analysis of pressure vessels with defects. Progress report, September 1976, 3:21640 (N-77-26550)
Significance of hydraulic testing of reactor pressure vessels from the standpoint of fracture mechanics, 3:21609
**STEELS/NEUTRON TRANSPORT**
Calculational tool for neutron propagation in steel and sodium media for fast reactor shielding applications, 3:22389
**STEELS/PHYSICAL PROPERTIES**
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STEELS/PHYSICAL RADIATION EFFECTS**
Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STEELS/STRESS CORROSION**
Materials aspects of SRP waste storage: corrosion and mechanical failure, 3:21180 (DP-1476)
**STEELS/WELDING**
Usage properties of special steels for pressurized water reactors: influence of composition and of manufacturing parameters, 3:21568
**STELLAR WINDS/HYDRODYNAMICS**
Interstellar bubbles. II. Structure and evolution, 3:22301
**STELLARATORS/PLASMA DRIFT**
Neoclassical diffusion in toroidal three-cut magnetic field, 3:22471
**STIRLING ENGINES/FEASIBILITY STUDIES**
Stirling engine feasibility study of an 80 to 100 hp engine and of improvement potential for emissions and fuel economy. Final report, 3:21855 (COO-2631-22)
**STOKES PARAMETERS/MEASURING METHODS**
Measurement of the Stokes parameters of light, 3:22130
**STRATOSPHERE/MIXING**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**STRATOSPHERE/RADIATION MONITORING**
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**STRATOSPHERE/RADIOACTIVITY**
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**STREAMS/POLLUTION CONTROL**
Stream preservation training, 3:21031
**STRIPED BASS/CONTAMINATION**
Concentrations of seventeen trace elements in the muscle and liver of a female striped bass Morone saxatilis (Environmental pollution during fossil fuel combustion), 3:22276 (EML-334)
**STRIPED BASS/RESPIRATION**
Respiratory response of juvenile chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil, 3:22275 (CONF-730386-)
**STRONG INTERACTIONS**
*See also HADRON-HADRON INTERACTIONS*
**STRONG INTERACTIONS/NUCLEAR FORCES**
New look at the nuclear force, 3:22380 (SLAC-PUB-1601)
**STRONTIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**STRONTIUM 89/ENVIRONMENTAL TRANSPORT**
EML fallout program data, 3:22155 (EML-334)
**STRONTIUM 89/RADIATION MONITORING**
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**STRONTIUM 90/ENVIRONMENTAL TRANSPORT**
Appendix to Environmental Measurements Laboratory environmental quarterly, 3:22205 (EML-334(App.))
EML fallout program data, 3:22155 (EML-334)
Quarterly $^{90}Sr$ deposition at world land sites (1976 data), 3:22158 (EML-334(App.))
Radiostrontium in milk and tap water (New York City), 3:22206 (EML-334(App.))
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**STRONTIUM 90/RADIATION MONITORING**
Plutonium and americium concentration along fresh-water food chains of the Great Lakes, U.S.A. Progress report, July 1976-September 30, 1977, 3:22220 (COO-3568-18)
Project Airstream (Radioactivity in lower stratosphere), 3:22156 (EML-334)
**STRONTIUM 90/SOLIDIFICATION**
$SrTiO_3$ synthesis process for solidification of strontium-90, 3:21175
**STYRENE POLYMERS**
*See POLYSTYRENE*
**SUBCRITICAL ASSEMBLIES**
Operation of a nuclear test gauge at low multiplications, 3:21627
**SUBCRITICALITY/STANDARDS**
Basis for subcritical limits in proposed criticality safety standard for mixed oxides, 3:21215
**SUGAR BEETS/GROWTH**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**SUGAR BEETS/REFINING**
Use of geothermal heat for sugar refining. Final report, October 1, 1976-May 31, 1977, 3:21450 (SAN/1317-3)
**SULFATES/ENVIRONMENTAL TRANSPORT**
Application of a statistical trajectory model to the simulation of sulfur pollution over northeastern United States, 3:22151
**SULFENAMIDES/BIOLOGICAL EFFECTS**
Search for radioprotective agents. Part XXXIX. Synethesis of some sulfenamides, 3:22259
**SULFHYDRYL COMPOUNDS**
*See THIOLS*
**SULFOCYANIDES**
*See THIOCYANATES*
**SULFONES/GAS CHROMATOGRAPHY**
Gas chromatographic method for determination of content of petroleum sulfones in wastewaters, 3:21018
**SULFUR/BIOLOGICAL ACCUMULATION**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**SULFUR/BIOLOGICAL EFFECTS**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**SULFUR/CHEMICAL REACTIONS**
Iron sponge treating of natural gas liquids, 3:21074 (CONF-7603113-)
**SULFUR/GAS CHROMATOGRAPHY**
Spectroscopic element detector for gas chromatography, 3:21929
**SULFUR/REMOVAL**
Catalysts for upgrading coal-derived liquids. Quarterly report, June 9-September 8, 1977, 3:20878 (FE-2011-9)
Coal liquefaction and desulfurization, utilizing synthesis gas (Patent), 3:20884
Method for desulfurizing char by acid washing and treatment with hydrogen gas (Patent), 3:20847
**SULFUR/RETENTION**
Pressurized fluidized bed combustion. Quarterly technical progress report, January-March 1977, 3:20927 (FE-1511-39)
**SULFUR/SPECTROSCOPY**
Spectroscopic element detector for gas chromatography, 3:21929
**SULFUR/X-RAY FLUORESCENCE ANALYSIS**
Method and device for determining the sulfur content of coal (Patent), 3:20897
Rapid simultaneous determination of sulfur and vanadium in crude oil using X-ray fluorescence, 3:21932
**SULFUR 32/ISOTOPIC EXCHANGE**
Oxygen and sulfur isotope equilibria in the $BaSO_4$-$HSO_4^-$-$H_2O$ system from 110 to 350°C and applications, 3:21457
**SULFUR 34/ISOTOPIC EXCHANGE**
Oxygen and sulfur isotope equilibria in the $BaSO_4$-$HSO_4^-$-$H_2O$ system from 110 to 350°C and applications, 3:21457
**SULFUR 35/ENVIRONMENTAL TRANSPORT**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**SULFUR COMPOUNDS/NATURAL OCCURRENCE**
Distribution of sulfur compounds in Emba and Mangyshlak crude oils, 3:21047
**SULFUR DIOXIDE/BIOLOGICAL EFFECTS**
Effects of $H_2S$, $H_2S + CO_2$ and $SO_2$ on lettuce, sugar beets, alfalfa, and cotton, 3:22249 (UCRL-13782)
**SULFUR DIOXIDE/ENVIRONMENTAL TRANSPORT**
Application of a statistical trajectory model to the simulation of sulfur pollution over northeastern United States, 3:22151
**SULFUR DIOXIDE/GASEOUS WASTES**
Method of removing sulfur dioxide from a gas, 3:20909
**SULFUR DIOXIDE/PURIFICATION**
Process for the treatment of flue and waste gases (Patent), 3:20908
**SULFUR DIOXIDE/REMOVAL**
Process for the treatment of flue and waste gases (Patent), 3:20908
**SULFUR FLUORIDES/ENERGY SPECTRA**
Contribution of electronically excited states to the radiation chemistry of organic systems. Progress report, September 1, 1976-August 31, 1977, 3:21992 (COO-913-68)
**SULFUR HYDRIDES**
*See HYDROGEN SULFIDES*
**SULFUR OXIDES/MONITORING**
1985 air pollution emissions, 3:22144 (DOE/PE-0001)
**SULFURIC ACID/CORROSIVE EFFECTS**
Electrochemical method of studying influence of additives on sulfuric acid corrosion of metals due to combustion products from medium-sulfur residual fuel oils, 3:21049
**SUNDESERT-1 REACTOR/REACTOR COMPONENTS**
Sundesert reliability engineering, 3:21570

**SUNDESERT-2 REACTOR/REACTOR COMPONENTS**
Sundesert reliability engineering, 3:21570
**SUPERCONDUCTING CABLES/FABRICATION**
LASL $Nb_3Ge$ conductor development. Eighth quarterly progress report, July 1-September 30, 1977, 3:21553 (LA-7037-PR)
**SUPERCONDUCTING CABLES/POWER TRANSMISSION LINES**
Picosecond pulses on superconducting striplines, 3:22007
**SUPERCONDUCTING CABLES/RESEARCH PROGRAMS**
LASL $Nb_3Ge$ conductor development. Eighth quarterly progress report, July 1-September 30, 1977, 3:21553 (LA-7037-PR)
**SUPERCONDUCTING CABLES/WAVE PROPAGATION**
Picosecond pulses on superconducting striplines, 3:22007
**SUPERCONDUCTING CAVITY RESONATORS**
Results of experiments on the rf superconducting accelerating section of the collective accelerator. II, 3:22108
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**SUPERCONDUCTING COILS**
Results of experiments on the rf superconducting accelerating section of the collective accelerator. II, 3:22108
Superconductor and cryogenic elements in a collective accelerator. I, 3:22107
**SUPERCONDUCTING COILS/FABRICATION**
Monolithic superconducting solenoids, 3:22009
**SUPERCONDUCTING COILS/PERFORMANCE**
Limits on the field of ohmic heating solenoids, applied to a tokamak TNS (NbTi), 3:22595 (CONF-771029-199)
**SUPERCONDUCTING COMPOSITES/JOSEPHSON EFFECT**
Influence of lattice defects and localized magnetic moments on the Josephson current in layered composites, 3:21909
**SUPERCONDUCTING JUNCTIONS/TUNNEL EFFECT**
Tunnel contacts in superconductors with a paramagnetic impurity, 3:22395
**SUPERCONDUCTING MAGNETS/COOLING SYSTEMS**
Helium distribution system for the Large Coil Test Facility (LCTF), 3:22594 (CONF-771029-193)
**SUPERCONDUCTING MAGNETS/DESIGN**
Mechanical design of ORPUS-3, 3:22591 (CONF-771029-149)
Superconducting magnetohydrodynamics magnet development program: Phase I. Quarterly technical progress report No. 3 (Revision A), November 1, 1976-January 31, 1977, 3:21759 (FE-2295-1)
Thermal design and analysis of superconductors for the toroidal field coils of TNS (NbTi), 3:22597 (WFPS-TME-059)
**SUPERCONDUCTING MAGNETS/FABRICATION**
Fast ramp superconductor for ohmic heating coils, 3:22592 (CONF-771029-180)
**SUPERCONDUCTING MAGNETS/REFRIGERATION**
Helium distribution system for the Large Coil Test Facility (LCTF), 3:22594 (CONF-771029-193)
**SUPERCONDUCTING MAGNETS/RESEARCH PROGRAMS**
ANL experimental program for pulsed superconducting coils, 3:22593 (CONF-771029-184)
**SUPERCONDUCTING MAGNETS/SAFETY**
Generic PSAR for the TF coil system of tokamak fusion reactors, 3:22632
**SUPERCONDUCTING MAGNETS/STRESS ANALYSIS**
Superconducting magnetohydrodynamics magnet development program: Phase I. Quarterly technical progress report No. 3 (Revision A), November 1, 1976-January 31, 1977, 3:21759 (FE-2295-1)
**SUPERCONDUCTING MAGNETS/SUPERCONDUCTING COILS**
Monolithic superconducting solenoids, 3:22009
**SUPERCONDUCTIVITY/PAIRING INTERACTIONS**
Ginzburg-Landau equations and quantum coherent phenomena in systems with electron-hole pairing, 3:22397
**SUPERCONDUCTORS**
*See also TYPE-II SUPERCONDUCTORS*
**SUPERCONDUCTORS/COLLECTIVE EXCITATIONS**
Effect of electron-phonon scattering on collective excitations in "dirty" superconductors, 3:22396
**SUPERCONDUCTORS/ELECTRON-PHONON COUPLING**
Effect of electron-phonon scattering on collective excitations in "dirty" superconductors, 3:22396
**SUPERCRITICAL FLOW**
*See TURBULENT FLOW*
**SUPERHEATERS/CONTROL EQUIPMENT**
Some problems of control of intermediate superheating of steam, 3:21495
**SUPERHEATERS/RELIABILITY**
Improvement of the reliability of waterwall superheater of the tpp-110 steam generators, 3:21508
**SUPERHEAVY ELEMENTS**
*See TRANS 104 ELEMENTS*
**SUPERTANKERS**
*See TANKER SHIPS*
**SURFACE AIR**
*See also AIR*
*EARTH ATMOSPHERE*
**SURFACE AIR/QUANTITATIVE CHEMICAL ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**SURFACE AIR/RADIATION MONITORING**
Background working levels and the remedial action guidelines, 3:22183 (HASL-325)
**SURFACE AIR/RADIOMETRIC ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**SURFACE AIR/SAMPLING**
Continuous and grab sampling determinations of radon concentrations, 3:22167 (HASL-325)
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
Environmental radon and thoron monitor, 3:22169 (HASL-325)
Measurements of $^{222}Rn$ flux with charcoal coanisters (Ground $^{222}Rn$ flux measurements), 3:22200 (HASL-325)
Passive environmental radon monitor, 3:22170 (HASL-325)
Radon and radon daughters: measurement and analysis successes and difficulties experienced by EPA, 3:22180 (HASL-325)
Survey of radon monitoring techniques, 3:22168 (HASL-325)
**SURFACE MINING/ACID MINE DRAINAGE**
Environmental control technology program studies at Argonne National Laboratory: surface mine effluents, 3:20911 (CONF-7710101-4)
**SURFACE MINING/EFFICIENCY**
Coal recovery from bituminous coal surface mines in the eastern United States: a survey. Information circular, 3:20917 (PB-269914)
State-of-the-art of functional use data measuring energy consumption in the commercial sector. Final report, 3:21797 (PB-269906)
**SURFACE MINING/LAND RECLAMATION**
Establishment, succession, and stability of vegetation on surface mined lands in eastern Montana. Annual progress report, June 1, 1975-February 29, 1976, 3:20914 (RLO/2228/T003-2)
**SURFACE WATERS**
*See also COASTAL WATERS*
*ESTUARIES*
*SEAS*
*STREAMS*
*WATER RESERVOIRS*
**SURFACE WATERS/SAMPLING**
Radon and radon daughters: measurement and analysis successes and difficulties experienced by EPA, 3:22180 (HASL-325)
**SURFACE WATERS/TRACER TECHNIQUES**
Comparison of the bromide ion and iodide ion neutron activable tracers with tritiated water as groundwater tracers, 3:22218
**SURFACE WATERS/WATER POLLUTION**
Oil pollution of inland waters in England and Wales, 3:21023
**SURMAC REACTOR/SPECIFICATIONS**
SURMAC: an advanced fuel fusion reactor, 3:22565
**SUSPENSIONS (FUEL)**
*See FUEL SLURRIES*
**SWEDEN/ELECTRIC POWER**
Industry in national planning: the power industry (1985 and 20005), 3:21742 (SIND-PM-1977-3)
**SWEDEN/ENERGY SUPPLIES**
Increasing energy consumption: will the plans be followed, 3:21750
**SWESSAR STANDARD PLANT**
*(Stone and Webster reference PWR Nuclear Power Plant.)*
**SWESSAR STANDARD PLANT/DESIGN**
Engineer-constructor's approach to reliability engineering in nuclear power plants, 3:21662
**SWIMMING POOLS/ENERGY CONSERVATION**
Buchloe indoor swimming pool as an example of energy saving and environmentally beneficial system solution, 3:21776
**SWIMMING POOLS/HEATING**
Combined heat recovery system in an indoor swimming pool of a school, 3:21794
Prefabricated houses with indoor swimming pool heated by heat pump, 3:21789
**SWIMMING POOLS/SOLAR HEATING SYSTEMS**
Installation and testing of a solar heating system for an aquatic recreational facility, 3:21345
**SWITCHES/DESIGN**
SCR series switch and impulse crowbar at the Lawrence Berkeley Laboratory for CTR neutral beam source development, 3:22602 (LBL-6382)
**SYNCHROTRONS**
*See also SERPUKHOV SYNCHROTRON*
**SYNCHROTRONS/BEAM DYNAMICS**
Beam depolarization in the magnetic field of a synchrotron, 3:22104

Synchrotron acceleration of variable charge heavy ions, 3:22105 (UCRL-Trans-1541)
**SYNCHROTRONS/DESIGN**
B-5 proton-ion synchrotron, 3:22100 (UCRL-Trans-1542)
**SYNTHANE PROCESS/WASTE WATER**
Treatability studies of condensate water from Synthane coal gasification, 3:20904 (PERC/RI-77/13)
**SYNTHESIS GAS/PRODUCTION**
Application of SGFM technology to other feedstocks: status report, 3:21304 (CONF-770235-)
**SYNTHETIC FUELS**
*See also MOBIL M-GASOLINE PROCESS*
*REFUSE DERIVED FUELS*
**SYNTHETIC FUELS/CHARGES**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**SYNTHETIC FUELS/ENERGY POLICY**
Suggestions for a Phase-II national energy policy. Final report, March 1977-September 1977, 3:21723 (FE/2660-1)
**SYNTHETIC FUELS/PRODUCTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
Facility deficiencies, 3:22082 (CONF-770235-)
Suggestions for a Phase-II national energy policy. Final report, March 1977-September 1977, 3:21723 (FE/2660-1)
Thermochemical water-splitting cycle applicable to fusion reactors for production of synthetic fuels, 3:22685

## T

**TALC/LUNG CLEARANCE**
Pulmonary deposition, translocation and clearance of inhaled neutron-activated talc in hamsters, 3:22277
**TALC/RETENTION**
Pulmonary deposition, translocation and clearance of inhaled neutron-activated talc in hamsters, 3:22277
**TALC/TRANSLOCATION**
Pulmonary deposition, translocation and clearance of inhaled neutron-activated talc in hamsters, 3:22277
**TANDEM ACCELERATORS**
*See VAN DE GRAAFF ACCELERATORS*
**TANKER SHIPS/COST**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 3. Ship safety. Final report, 3:21630 (PB-269725)
**TANKER SHIPS/DESIGN**
LNG transport costs cut by concrete, 3:21094
Nuclear powered tanker. maritime design study for 600,000 DWT nuclear tanker. Volume 2. Preliminary design. Final report, 3:21629 (PB-269724)
**TANKER SHIPS/ECONOMICS**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 5. Economic evaluation. Final report, 3:21632 (PB-269727)
**TANKER SHIPS/ENGINEERING**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 4. Engineering and production support. Final report, 3:21631 (PB-269726)
**TANKER SHIPS/ENVIRONMENTAL IMPACTS**
Review of environmental issues of the transportation of Alaskan North Slope crude oil. Final report, 3:21730 (PB-270088)
**TANKER SHIPS/MARKET**
Situation on the LNG tanker market, 3:21092
**TANKER SHIPS/POLLUTION CONTROL**
1973 IMCO convention: a tanker operator's viewpoint, 3:21022
**TANKER SHIPS/SAFETY**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 3. Ship safety. Final report, 3:21630 (PB-269725)
**TANKER SHIPS/SPECIFICATIONS**
Nuclear powered tanker. Maritime design study for 600,000 DWT nuclear tanker. Volume 1. Preliminary specifications (Mod 1). Final report, 3:21628 (PB-269723)
**TANKS/CLEANING**
Low-pressure hydraulic technique for slurrying radioactive sludges in waste tanks, 3:21165 (DP-1468)
**TANKS/CONSTRUCTION**
Use of concrete in the new terrastore underground storage system, 3:21057
**TANTALUM/CASTING**
Present position of electron beam melting and casting technology, 3:21837
**TANTALUM/COMPRESSIBILITY**
Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**TANTALUM/ELECTRON BEAM MELTING**
Present position of electron beam melting and casting technology, 3:21837
**TANTALUM/PERMEABILITY**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**TANTALUM/SELF-DIFFUSION**
Anomalous diffusion in bcc metals of the 5th and 6th groups (Mo, Nb, Ta, W), 3:21891
**TANTALUM ALLOYS/PERMEABILITY**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**TANTALUM SILICIDES/EXPLOSIVE FORMING**
Shock synthesis of superconducting $Ta_3Si$, 3:21913
**TANTALUM SILICIDES/TRANSITION TEMPERATURE**
Shock synthesis of superconducting $Ta_3Si$, 3:21913
**TANTALUM SULFIDES/JOSEPHSON EFFECT**
Influence of lattice defects and localized magnetic moments on the Josephson current in layered composites, 3:21909
**TAR**
*See also BITUMENS*
*SHALE TAR*
**TAR/PYROLYSIS**
Application of SGFM technology to other feedstocks: status report, 3:21304 (CONF-770235-)
**TAR SANDS**
*See OIL SANDS*
**TATB**
*(1,3,5-Triamino-2,4,6-trinitrobenzene.)*
**TATB/IMPURITIES**
Summary of chlorine free synthesis of TATB. Process Development Endeavor No. 106, 3:22133 (MHSMP-77-57)
**TATB/PHOTOMETRY**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**TAU PARTICLE/MASS**
Properties of the proposed tau charged lepton, 3:22328
**TAXES/MANUALS**
1977 guidebook to California taxes with special emphasis on relationship to Federal taxes, 3:21687
**TBP**
*(Tributyl phosphate.)*
**TBP/COMBUSTION**
Volume reduction system for solid and liquid TRU waste from the nuclear fuel cycle: April-June 1977, 3:21172 (MLM-2463)
**TBP/PURIFICATION**
Method for increasing the lifetime of an extraction medium used for reprocessing spent nuclear fuel and/or breeder materials (Patent), 3:21154
**TECHNETIUM 99/SCINTISCANNING**
Alternative displays in nuclear medicine, 3:22243
**TECHNOLOGY TRANSFER/SOCIAL IMPACT**
Information and data flows in societal problem areas: focus-energy. Final report, 3:21683 (PB-269497)
**TELESCOPE COUNTERS/DESIGN**
Background effects in scintillation counter telescopes in the upper atmosphere, 3:22125
**TELLURIUM/ABSORPTION SPECTROSCOPY**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
**TELLURIUM/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**TELLURIUM 126 TARGET/ARGON 40 REACTIONS**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**TELLURIUM 130 TARGET/ARGON 40 REACTIONS**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**TELLURIUM COMPOUNDS/PHYSICAL RADIATION EFFECTS**
Electrical and recombination characteristics of Cd/sub x/Hg/sub 1-x/Te irradiated with electrons at T=300° K, 3:21897
**TERBIUM 150/BETA-PLUS DECAY**
Decay of $^{150}$Tb, 3:22368 (TREE-1115)
**TERBIUM 150/ELECTRON CAPTURE DECAY**
Decay of $^{150}$Tb, 3:22368 (TREE-1115)
**TERBIUM 150/ENERGY-LEVEL TRANSITIONS**
Decay of $^{150}$Tb, 3:22368 (TREE-1115)
**TERMINAL FACILITIES**
*See also LIQUEFIED NATURAL GAS*
Offshore terminal with underground storage at sea, 3:21056

**TERMINAL FACILITIES/SITE SELECTION**
Energy facility siting in the Great Lakes Coastal Zone: analysis and policy options. Final report (State and Federal roles), 3:21684 (PB-271104)
**TERPENES/MOLECULAR STRUCTURE**
Kempene-1 and -2, unusual tetracyclic diterpenes from Nasutitermes termite soldiers, 3:21980
**TERRESTRIAL BACKGROUND**
*See BACKGROUND RADIATION*
**TEST FACILITIES/INSPECTION**
Cresap Test Center inspection and acceptance services. R and D report No. 82, interim report No. 8, 3:20877 (FE-1234-8)
**TEST FACILITIES/SPECIFICATIONS**
Cresap Test Center inspection and acceptance services. R and D report No. 82, interim report No. 8, 3:20877 (FE-1234-8)
**TETRAHYDRONAPHTHALENE**
*See TETRALIN*
**TETRALIN/LIQUID COLUMN CHROMATOGRAPHY**
Separation of hydroaromatics and polycyclic aromatic hydrocarbons and determination of tetralin and naphthalene in coal-derived solvents, 3:20893
**TEXAS/NATURAL GAS INDUSTRY**
Relationship of new Texas sour gas rules to gas conditioning operations, 3:21088 (CONF-7603113-)
**TEXAS/STRATIGRAPHY**
Supplemental field and literature investigation of the upper cretaceous Austin Group (chalk) of Texas with regard to its potential for radioactive-waste isolation, 3:21191 (Y/OWI/SUB-4310/4)
**TEXAS/URANIUM DEPOSITS**
Preliminary study of uranium favorability of the Wilcox and Claiborne Groups (Eocene) in Texas, 3:21121 (GJBX-7(78))
**TEXT DEVICES/ENERGY STORAGE**
TEXT Energy Storage System, 3:22604 (ORO-5594-9)
**TEXTILE INDUSTRY/SOLAR PROCESS HEAT**
Application of solar energy to the supply of hot water for textile dyeing. Final report, CDRL/PA 10, 3:21360 (SAN/1220-1)
**TEXTILE INDUSTRY/TOTAL ENERGY SYSTEMS**
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21323 (ALO/3987-1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 ft² knitwear plant), 3:21324 (ALO/3987-1/3)
**TEXTILES/DRYING**
Radio frequency drying of papers and textiles, 3:21836
**TFR TOKAMAK/NEUTRON DOSIMETRY**
Radiation protection around a controlled fusion research facility: the Tokamak of Fontenay-aux-Roses, TFR, 3:22631 (UCRL-Trans-11297)
**TFR TOKAMAK/X-RAY DOSIMETRY**
Radiation protection around a controlled fusion research facility: the Tokamak of Fontenay-aux-Roses, TFR, 3:22631 (UCRL-Trans-11297)
**THERMAL CONDUCTION**
*(Heat transfer by conduction.)*
**THERMAL CONDUCTION/VARIATIONAL METHODS**
Consequence of the invariance of Biot's variational principle in thermal conduction, 3:22400
**THERMAL EFFLUENTS/BIOLOGICAL EFFECTS**
Isolation of pathogenic Naegleria from artificially heated waters, 3:22228 (CONF-770961-3)
**THERMAL ENERGY STORAGE EQUIPMENT/DESIGN**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem (Sensible heat storage using Caloria HT43 and mixture of gravel and sand), 3:21321 (SAN/1108-8/5)
**THERMAL ENERGY STORAGE EQUIPMENT/ECONOMICS**
Feasibility study of transporting offshore OTEC-produced energy to shore by thermal media. Project 8980 third topical report, November 1976-July 1977, 3:21326 (DSE/2426-19)
**THERMAL ENERGY STORAGE EQUIPMENT/FEASIBILITY STUDIES**
Feasibility study of transporting offshore OTEC-produced energy to shore by thermal media. Project 8980 third topical report, November 1976-July 1977, 3:21326 (DSE/2426-19)
Macro-encapsulation of heat storage phase-change materials for use in residential buildings. First quarterly progress report, September 29-December 29, 1976, 3:21672 (ORO/5217-1)
**THERMAL ENERGY STORAGE EQUIPMENT/HEAT PIPES**
Material selection considerations for fluoride thermal energy storage containment in a sodium heat pipe environment. Final report 1 June-August 1976, 3:21671 (AD-A-042389)
**THERMAL ENERGY STORAGE EQUIPMENT/MATERIALS**
Solar energy systems: survey of materials performance. Final report, 3:21331 (NBSIR-77-1314)
**THERMAL ENERGY STORAGE EQUIPMENT/PERFORMANCE TESTING**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem (Sensible heat storage using Caloria HT43 and mixture of gravel and sand), 3:21321 (SAN/1108-8/5)
**THERMAL ENERGY STORAGE EQUIPMENT/SPECIFICATIONS**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem (Sensible heat storage using Caloria HT43 and mixture of gravel and sand), 3:21321 (SAN/1108-8/5)
**THERMAL INSULATION/EVALUATION**
Assessment of fibrous insulation materials for the selenide isotope generator system, 3:21241 (ORNL/TM-5908)
**THERMAL INSULATION/FABRICATION**
Thermally insulated panel (Patent), 3:21774
**THERMAL INSULATION/PERFORMANCE**
Urea-formaldehyde based foam insulations: an assessment of their properties and performance. Final report, 3:21773 (PB-269779)
**THERMAL INSULATION/PHYSICAL PROPERTIES**
Urea-formaldehyde based foam insulations: an assessment of their properties and performance. Final report, 3:21773 (PB-269779)
**THERMAL POWER PLANTS**
*See also GEOTHERMAL POWER PLANTS*
**THERMAL POWER PLANTS/BOILERS**
Specific features of starting operating conditions of a TGMP-324 gastight boiler of a 300 MW monoblock, 3:21493
**THERMAL POWER PLANTS/CHEMICAL EFFLUENTS**
Simulation of chlorinated water discharges from power plants on estuaries and rivers, 3:22216
**THERMAL POWER PLANTS/COOLING SYSTEMS**
Effect of heated water discharge on oxygen content in the water supply source of thermal power plants, 3:21523
Water supply for thermal and atomic electrical power stations and water conservation, 3:21481 (ORNL-tr-4519)
**THERMAL POWER PLANTS/COOLING TOWERS**
Federal role in dry and wet-dry cooling tower research, development, and demonstration, 3:21472 (COO/4188-2)
**THERMAL POWER PLANTS/FEEDWATER HEATERS**
Performance of tube-to-tubeplate welded joints in high pressure feed heaters, 3:21514
**THERMAL POWER PLANTS/FLUE GAS**
Operation of an electroprecipitator influence of the main parameters, 3:21526
**THERMAL POWER PLANTS/START-UP**
Specific features of starting operating conditions of a TGMP-324 gastight boiler of a 300 MW monoblock, 3:21493
**THERMAL POWER PLANTS/STEAM GENERATORS**
Dynamic characteristics of the P-49 steam generator for a 500 MW power block, 3:21489
Investigation of the hydrodynamics of two-phase flow with nonuniform supply of vapor over the cross section, 3:21515
**THERMAL POWER PLANTS/THERMAL EFFLUENTS**
Effect of heated water discharge on oxygen content in the water supply source of thermal power plants, 3:21523
**THERMAL POWER PLANTS/WATER POLLUTION**
Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76, 3:22212 (PB-269652)
**THERMAL POWER PLANTS/WATER REQUIREMENTS**
Water supply for thermal and atomic electrical power stations and water conservation, 3:21481 (ORNL-tr-4519)
**THERMAL PROPERTIES**
*See THERMODYNAMIC PROPERTIES*
**THERMAL WATERS/ACTIVATION ANALYSIS**
Nuclear techniques in geochemical studies of hydrothermal systems, 3:21412
**THERMAL WATERS/X-RAY FLUORESCENCE ANALYSIS**
Nuclear techniques in geochemical studies of hydrothermal systems, 3:21412
**THERMIONIC CONVERTERS/FEASIBILITY STUDIES**
Some problems involved in the development of a solar thermionic power plant, 3:21301
**THERMOCHEMICAL HEAT STORAGE/MEETINGS**
International conference on the photochemical conversion and storage of solar energy, 3:21312 (CONF-760889-)
**THERMODYNAMIC PROPERTIES**
Perturbed-hard-chain theory for correlation of thermodynamic properties, 3:21040 (CONF-770375-)
**THERMOELECTRIC GENERATORS/THERMAL INSULATION**
Assessment of fibrous insulation materials for the selenide isotope generator system, 3:21241 (ORNL/TM-5908)
**THERMOELECTRIC MATERIALS/RESEARCH PROGRAMS**
Thermoelectric materials evaluation program. Quarterly technical task report No. 46 (Minnesota Mining and Manufacturing Company, Technical Ceramic Products Div., St. Paul, 10/1 to 12/31/1975), 3:21915 (MMM-2473-0422)

**THERMOLUMINESCENT DOSEMETERS/PERFORMANCE**
What do we sample for and for how long (Ra and daughter products monitoring), 3:22178 (HASL-325)
**THERMONUCLEAR DEVICES**
*See also LEVITRON DEVICES*
*MIGMA DEVICES*
*ORMAK DEVICES*
*STELLARATORS*
*TOKAMAK DEVICES*
**THERMONUCLEAR DEVICES/RESEARCH PROGRAMS**
Status report on the current DMFE review of alternative magnetic confinement systems, 3:22562
**THERMONUCLEAR FUELS/CONFIGURATION**
Low aspect ratio double shells for high density and high gain, 3:22650 (UCRL-80104)
**THERMONUCLEAR FUELS/FABRICATION**
Fabrication of cryogenic laser fusion targets, 3:21236 (UCRL-79442)
**THERMONUCLEAR FUELS/FUSION YIELD**
Use of advanced fuels in pellet implosion reactor engineering, 3:22672
**THERMONUCLEAR FUELS/IMPLOSIONS**
Discussion of diagnostics techniques in particle beam fusion at Sandia Laboratories, 3:22421 (SAND-77-1829C)
Use of advanced fuels in pellet implosion reactor engineering, 3:22672
**THERMONUCLEAR FUELS/LASER IMPLOSIONS**
Long pulse microsphere experiments at 3 TW, 3:22646 (UCRL-79779)
**THERMONUCLEAR FUELS/MEASURING METHODS**
Problems with rho R measurements: what are the ways out, 3:21237 (UCRL-79772)
**THERMONUCLEAR FUELS/NEUTRON EMISSION**
Scintillator-photomultiplier response to a simulated REB generated thermonuclear neutron pulse, 3:22641 (SAND-77-1592C)
**THERMONUCLEAR FUELS/OPTIMIZATION**
Recent advances in near-term laser-fusion target design, 3:22644 (UCRL-79736)
**THERMONUCLEAR FUELS/PERFORMANCE**
Studies of deuterium-fueled Tokamak reactors, 3:22624
**THERMONUCLEAR FUELS/PLASMA DIAGNOSTICS**
Discussion of diagnostics techniques in particle beam fusion at Sandia Laboratories, 3:22421 (SAND-77-1829C)
**THERMONUCLEAR FUELS/RAYLEIGH-TAYLOR INSTABILITY**
Stability of multiple shell ICF capsules, 3:22640 (SAND-77-1495C)
**THERMONUCLEAR FUELS/RELATIVISTIC BEAM INJECTION**
Effectiveness of interaction of an electron flux with high $\nu/\gamma$ with preliminary heating of a plane target, 3:22415 (ORNL-tr-4537)
**THERMONUCLEAR FUELS/X-RAY SPECTRA**
Crystal spectograph for imaging high-density targets, 3:22648 (UCRL-79787)
**THERMONUCLEAR IGNITION**
Fusion-fission analogy, 3:22404 (CONF-771109-85)
**THERMONUCLEAR REACTIONS/EFFICIENCY**
Particle and x-ray energy measurements in laser-plasma interaction experiments, 3:22428
**THERMONUCLEAR REACTIONS/ENERGY LOSSES**
Thermalisation of energetic charged particles in fusion plasma with quantum electrodynamic considerations, 3:22585
**THERMONUCLEAR REACTIONS/NEUTRON DETECTION**
Activation detectors for recording pulsed fluxes of fast neutrons, 3:22121 (ORNL-tr-4529)
**THERMONUCLEAR REACTOR COOLING SYSTEMS/COOLANTS**
Liquid metal requirements for inertial confinement fusion, 3:22608 (UCRL-80424)
**THERMONUCLEAR REACTOR COOLING SYSTEMS/HYDRAULICS**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**THERMONUCLEAR REACTOR COOLING SYSTEMS/LEAKS**
Redundant coolant capability for fusion reactor blankets, 3:22612
**THERMONUCLEAR REACTOR COOLING SYSTEMS/MECHANICAL PROPERTIES**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**THERMONUCLEAR REACTOR COOLING SYSTEMS/THERMAL STRESSES**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**THERMONUCLEAR REACTOR COOLING SYSTEMS/THERMODYNAMIC PROPERTIES**
Thermal-hydraulic and mechanical analyses for near-term fusion reactor blanket designs, 3:22610
**THERMONUCLEAR REACTOR COOLING SYSTEMS/TWO-PHASE FLOW**
Local properties of vertical mercury-argon two-phase flow in a circular tube under transverse magnetic field (Thermonuclear Reactor Cooling Systems), 3:22609
**THERMONUCLEAR REACTOR COOLING SYSTEMS/VALVES**
Low-noise control valve. II, 3:22607 (CONF-771029-153)
**THERMONUCLEAR REACTOR MATERIALS/CORROSION**
Corrosion resistance of vanadium and vanadium alloys as structural materials in a lithium cooled fusion reactor, 3:21893
**THERMONUCLEAR REACTOR MATERIALS/MATERIALS TESTING**
Dosimetry needs for the Magnetic Fusion Materials Program, 3:22677 (CONF-771036-6)
**THERMONUCLEAR REACTOR MATERIALS/MECHANICAL PROPERTIES**
HEDL magnetic fusion energy programs. Progress report, April-June 1977, 3:22681 (HEDL-TME-77-81)
**THERMONUCLEAR REACTOR MATERIALS/NEUTRON DOSIMETRY**
Dosimetry needs for the Magnetic Fusion Materials Program, 3:22677 (CONF-771036-6)
**THERMONUCLEAR REACTOR MATERIALS/PHYSICAL RADIATION EFFECTS**
Fission-fragment-induced helium blistering of $^{252}$Cf-exposed surfaces, 3:22679 (DP-MS-77-47)
HEDL magnetic fusion energy programs. Progress report, April-June 1977, 3:22681 (HEDL-TME-77-81)
Review of neutron and charged particle intercorrelation programs, 3:22680 (HEDL-SA-1252)
**THERMONUCLEAR REACTOR MATERIALS/REPROCESSING**
Considerations of the recycle time for radioactive titanium alloy structures, 3:22687
**THERMONUCLEAR REACTOR WALLS**
*See also FIRST WALL*
**THERMONUCLEAR REACTOR WALLS/ELECTRIC CONDUCTIVITY**
Resistive requirements for the vacuum wall of a Tokamak Fusion Reactor, 3:22676 (CONF-771029-182)
**THERMONUCLEAR REACTOR WALLS/STRESS ANALYSIS**
First wall stress analysis for a Tokamak reactor, 3:22584
**THERMONUCLEAR REACTOR WALLS/TEMPERATURE DISTRIBUTION**
Temperature distributions in fusion reactor first-wall systems, 3:22590
**THERMONUCLEAR REACTORS**
*(For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.)*
*See also D-T REACTORS*
*E-BEAM TYPE REACTORS*
*I-BEAM TYPE REACTORS*
*LASER FUSION REACTORS*
*MAGNETIC MIRROR TYPE REACTORS*
*THERMONUCLEAR REACTOR WALLS*
*TOKAMAK TYPE REACTORS*
**THERMONUCLEAR REACTORS/COMMERCIALIZATION**
Perspectives on fusion power commercialization, 3:22556
**THERMONUCLEAR REACTORS/DESIGN**
Experiment in undergraduate education: the fusion design team, 3:22574
**THERMONUCLEAR REACTORS/ECONOMIC DEVELOPMENT**
Effects of fusion reactor size and availability on utility operations, 3:22558
**THERMONUCLEAR REACTORS/ELECTRIC POWER**
Impact of advanced fuel fusion on electric power transmission, 3:22549
**THERMONUCLEAR REACTORS/ENERGY BALANCE**
Generalized criterion for controlled fusion, 3:22583
Unified criterion for proximity to controlled fusion, 3:22582
**THERMONUCLEAR REACTORS/GAS FLOW**
Hydrogen transport in a two-dimensional torodial plasma, 3:22469
**THERMONUCLEAR REACTORS/LASER-RADIATION HEATING**
Status of laser solenoid fusion concept, 3:22569
**THERMONUCLEAR REACTORS/MAGNETIC FIELD CONFIGURATIONS**
Control of the formation of a compact toroidal structure with a pulsed barrier field, 3:22601 (UCRL-Trans-11290)
**THERMONUCLEAR REACTORS/NEUTRAL BEAM SOURCES**
SCR series switch and impulse crowbar at the Lawrence Berkeley Laboratory for CTR neutral beam source development, 3:22602 (LBL-6382)
**THERMONUCLEAR REACTORS/NEUTRON SPECTRA**
Determination of fast neutron spectra with activation techniques: its application in a fusion reactor blanket model, 3:22581

**THERMONUCLEAR REACTORS/PLANNING**
Fusion moves from plasma physics research to reactor engineering, 3:22545
Overview of near-term magnetic confinement fusion reactor designs, 3:22559
Perspectives on the development of fusion power by magnetic confinement, 1977, 3:22538 (DOE/ET-0002)
**THERMONUCLEAR REACTORS/PLASMA CONFINEMENT**
Containment of an adiabatic plasma on magnetic lines of force by a self-generated electrostatic field, 3:22410
**THERMONUCLEAR REACTORS/RESEARCH PROGRAMS**
Are generalized or unified criteria possible, 3:22547
Progress in fusion technology, 3:22571
Research and design-construction work of the Scientific Research Institute of Electrophysical Apparatus in the field of controlled thermonuclear fusion, 3:22576 (ORNL-tr-4531)
**THERMONUCLEAR REACTORS/REVIEWS**
Clean fusion concepts and efforts: a survey, 3:22546
Nuclear fusion: the energy source for the future, 3:22552
Potential of controlled nuclear fusion, 3:22550
Quest for fusion power, 3:22551
Thermonuclear fusion power, 3:22553
**THERMONUCLEAR REACTORS/SIZE**
Effects of fusion reactor size and availability on utility operations, 3:22558
**THERMONUCLEAR REACTORS/SYNTHETIC FUELS**
Thermochemical water-splitting cycle applicable to fusion reactors for production of synthetic fuels, 3:22685
**THERMONUCLEAR REACTORS/TECHNOLOGY ASSESSMENT**
Chemical engineering side of nuclear fusion power, 3:22554
**THERMONUCLEAR WEAPONS**
*See NUCLEAR WEAPONS*
**THETA PINCH/FLUTE INSTABILITY**
Lagrangian description of flute drift turbulence of $\theta$-pinch plasma, 3:22411
**THETA PINCH/PLASMA DIAGNOSTICS**
10.6 $\mu$m interferometry and Faraday rotation measurements on a theta-pinch plasma, 3:22433
**THETA PINCH/PLASMA DRIFT**
Lagrangian description of flute drift turbulence of $\theta$-pinch plasma, 3:22411
**THIO COMPOUNDS**
*See ORGANIC SULFUR COMPOUNDS*
**THIOCYANATES/CHEMICAL REACTION KINETICS**
Trans effects in octahedral complexes: substitution of chloromethyl- and dichloromethylpentaaquochromium(III) ions by thiocyanate ion, 3:21957
**THIOLS/REMOVAL**
Sweetening of light hydrocarbon liquids, 3:21073 (CONF-7603113-)
**THORAX**
*See CHEST*
**THOREX PROCESS/RESEARCH PROGRAMS**
Investigation of special resins for the extraction-chromatogaphic separation of Np and Pu from the process stream of a reprocessing plant for HTR fuel elements, 3:21158 (GERHTR-181)
**THORIUM/QUANTITATIVE CHEMICAL ANALYSIS**
Lunar sample studies, 3:21917 (N-77-27053)
**THORIUM 215/NUCLEAR STRUCTURE**
Nuclear data sheets for A=215, 3:22372
**THORIUM 219/NUCLEAR STRUCTURE**
Nuclear data sheets for A=219, 3:22373
**THORIUM 223/FRANCIUM**
Nuclear data sheets for A=223, 3:22376
**THORIUM 223/NUCLEAR STRUCTURE**
Nuclear data sheets for A=223, 3:22376
**THORIUM 227/NUCLEAR STRUCTURE**
Nuclear data sheets for A=227, 3:22377
**THORIUM 232 TARGET/NEUTRON REACTIONS**
Delayed neutron spectra from $^{232}$Th, $^{233}$U, $^{235}$U, and $^{239}$Pu, 3:22379 (RLO/2225/T3-6)
**THORIUM COMPOUNDS/ABSORPTION SPECTRA**
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
**THORIUM COMPOUNDS/CHEMICAL PREPARATION**
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
**THORIUM COMPOUNDS/MAGNETIC RESONANCE**
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
**THORIUM COMPOUNDS/MAGNETIC SUSCEPTIBILITY**
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
**THORIUM OXIDES/NEUTRON SPECTRA**
Measurement and analysis of neutron spectrum in spherical pile of thoria, 3:21147
**THORON**
*See RADON 220*
**THTR-300 REACTOR/COMPRESSORS**
Design, erection, maintenance and operation of helium compressors for the Thorium High Temperature Reactor at Schmehausen, 3:21575
**THYROID/RADIATION DOSES**
Evaluation of models for assessing compliance with environmental radiation regulations, 3:22208
**TIDAL POWER PLANTS**
Analysis of a proposed tidal power plant in the Gulf of Mexico, 3:21458 (UCID-17677)
**TIN/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**TIN 116 TARGET/OXYGEN 16 REACTIONS**
Hsub(1/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce, 3:22362
**TIN 118 TARGET/OXYGEN 16 REACTIONS**
Hsub(1/2) and gsub(7/2) band structures in $^{131}$Ce and $^{129}$Ce, 3:22362
**TIN 122 TARGET/ARGON 40 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**TIN 124 TARGET/ARGON 40 REACTIONS**
Angular momentum limits in fusion reactions induced by argon and krypton projectiles, 3:22364
**TIN OXIDES/ELECTRICAL PROPERTIES**
Effects of heat treatment on the optical and electrical properties of indium-tin oxide films, 3:21903
**TIN OXIDES/OPTICAL PROPERTIES**
Effects of heat treatment on the optical and electrical properties of indium-tin oxide films, 3:21903
**TISSUES/CHEMICAL ANALYSIS**
Analytical methods for polynuclear aromatic hydrocarbons in crude oils, heating oils, and marine tissues, 3:21052
Evaluation of some methods of analysis for petroleum hydrocarbons in marine organisms, 3:21053
**TITANIUM/CHEMICAL VAPOR DEPOSITION**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**TITANIUM/REPROCESSING**
Considerations of the recycle time for radioactive titanium alloy structures, 3:22687
**TITANIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**TITANIUM ALLOYS**
*See also TITANIUM BASE ALLOYS*
**TITANIUM ALLOYS/CORROSION PROTECTION**
Increasing the endurance limit and corrosion resistance of light-alloy drill pipes, 3:20983
**TITANIUM ALLOYS/REPROCESSING**
Considerations of the recycle time for radioactive titanium alloy structures, 3:22687
**TITANIUM BASE ALLOYS/PROTECTIVE COATINGS**
Wear resistant coatings for titanium alloys. Final report 15 March 1976-15 March 1977 (Cr-Mo coating on Ti-8Al-1V-1Mo substrate), 3:21872 (AD-A-042443)
**TITANIUM OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**TITANIUM OXIDES/REFRACTIVITY**
Refractive index and surface layers of ceramic (Pb,La)(Zr,Ti)$O_3$ compounds, 3:21904
**TMX DEVICES/DESIGN**
Tandem mirror reactor, 3:22541 (UCRL-80075)
**TNS REACTOR/COST**
Computer code for the costing and sizing of TNS tokamaks, 3:22544 (WFPS-TME-062)
**TNS REACTOR/IMPURITIES**
Impurity and gas throughput control for TNS, 3:22580 (WFPS-TME-060)
**TNS REACTOR/MAINTENANCE**
Remote servicing considerations for near term tokamak power reactors (TNS). Final summary, 3:22678 (CONF-771109-84)

**TNS REACTOR/PLANNING**
Oak Ridge TNS Program 1976-1977. Integration of engineering reality brings us closer to realizable reactor, 3:22534 (CONF-771029-150)
**TNS REACTOR/REMOTE HANDLING**
Remote servicing considerations for near term tokamak power reactors (TNS). Final summary, 3:22678 (CONF-771109-84)
**TNS REACTOR/SIZE**
Computer code for the costing and sizing of TNS tokamaks, 3:22544 (WFPS-TME-062)
**TNS REACTOR/SUPERCONDUCTING COILS**
Limits on the field of ohmic heating solenoids, applied to a tokamak TNS (NbTi), 3:22595 (CONF-771029-199)
**TNS REACTOR/SUPERCONDUCTING MAGNETS**
Thermal design and analysis of superconductors for the toroidal field coils of TNS (NbTi), 3:22597 (WFPS-TME-059)
**TOKAMAK DEVICES**
*See also ATC DEVICES*
*JFT-2 TOKAMAK*
*JFT-2A TOKAMAK*
*PLT DEVICES*
*TFR TOKAMAK*
**TOKAMAK DEVICES/IMPURITIES**
Superthermal X radiation in the TM-3 tokamak, 3:22453
**TOKAMAK DEVICES/KINK INSTABILITY**
Macroscopic kink instabilities in toroidal relativistic beams, 3:22491
**TOKAMAK DEVICES/NEUTRAL-PARTICLE TRANSPORT**
Analytical solution for the distribution of neutral particles in a Maxwellian plasma using the method of singular eigenfunctions, 3:22462
**TOKAMAK DEVICES/PLASMA INSTABILITY**
Instabilities in the TM-3 tokamak connected with runaway electron beam, 3:22504
**TOKAMAK DEVICES/RUNAWAY ELECTRONS**
Instabilities in the TM-3 tokamak connected with runaway electron beam, 3:22504
Magnetic extraction of runaway electrons from a tokamak plasma, 3:22450
Quasi-linear relaxation of runaway electrons in a hf heated tokamak plasma, 3:22414
**TOKAMAK DEVICES/X-RAY SPECTRA**
Superthermal X radiation in the TM-3 tokamak, 3:22453
**TOKAMAK TYPE REACTORS/BREEDING BLANKETS**
Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER-582)
**TOKAMAK TYPE REACTORS/COMMERCIALIZATION**
Commercial feasibility of fusion power based on the tokamak concept, 3:22557
**TOKAMAK TYPE REACTORS/COST**
Major cost drivers for tokamak fusion power plants, 3:22573
**TOKAMAK TYPE REACTORS/DESIGN**
Design and physical principles of the finger-ring T-12 Tokamak with two axisymmetrical diverters, 3:22555 (ORNL-tr-4530)
Design approaches for enchancing the engineering feasibility of tokamak power reactors, 3:22572
**TOKAMAK TYPE REACTORS/ECONOMIC DEVELOPMENT**
Major cost drivers for tokamak fusion power plants, 3:22573
Wall load and lifetime goals for tokamak power plants, 3:22586
**TOKAMAK TYPE REACTORS/ELECTRIC GENERATORS**
EPR ohmic heating energy storage, 3:22605 (WFPS-TME-064)
**TOKAMAK TYPE REACTORS/FAILURE MODE ANALYSIS**
Reliability requirements for admissible radiological hazards from fusion reactors, 3:22633
**TOKAMAK TYPE REACTORS/FEASIBILITY STUDIES**
Commercial feasibility of fusion power based on the tokamak concept, 3:22557
**TOKAMAK TYPE REACTORS/FIRST WALL**
Fusion reactor first wall/blanket systems analysis: tokamak concepts, 3:22578 (EPRI-ER-582)
**TOKAMAK TYPE REACTORS/IMPURITIES**
Effects of impurities on alpha particle loss in a tokamak reactor, 3:22587
Plasma-wall-divertor model for tokamaks, 3:22588
**TOKAMAK TYPE REACTORS/ION TEMPERATURE**
Status of the USA program on the development of submillimeter lasers to measure ion temperatures, 3:22419 (CONF-770954-5)
**TOKAMAK TYPE REACTORS/MAGNET COILS**
Compact high-field ignition test reactor (HFITR) using bitter magnets, 3:22600
**TOKAMAK TYPE REACTORS/MAGNETOHYDRODYNAMICS**
Plasma engineering studies for the tokamak experimental power reactor, 3:22535 (CONF-771029-190)
**TOKAMAK TYPE REACTORS/NEUTRAL ATOM BEAM INJECTION**
Collective processes in the case of injection of rapid neutral atoms in a tokamak with noncircular cross section, 3:22416 (ERDA-tr-316)
**TOKAMAK TYPE REACTORS/PLANNING**
Plasma engineering considerations for a medium-field ignition test reactor, 3:22561
**TOKAMAK TYPE REACTORS/PLASMA DIAGNOSTICS**
Scheme for $CO_2$ laser scattering to measure the ion temperature in a tokamak plasma, 3:22441
**TOKAMAK TYPE REACTORS/POWER SUPPLIES**
Research and design-construction work of the Scientific Research Institute of Electrophysical Apparatus in the field of controlled thermonuclear fusion, 3:22576 (ORNL-tr-4531)
**TOKAMAK TYPE REACTORS/RADIATION HAZARDS**
Reliability requirements for admissible radiological hazards from fusion reactors, 3:22633
**TOKAMAK TYPE REACTORS/SAFETY**
Generic PSAR for the TF coil system of tokamak fusion reactors, 3:22632
**TOKAMAK TYPE REACTORS/SPECIFICATIONS**
Research and desigr-construction work of the Scientific Research Institute of Electrophysical Apparatus in the field of controlled thermonuclear fusion, 3:22576 (ORNL-tr-4531)
TDHR-a Tokamak demonstraction hybrid reactor, 3:22560
**TOKAMAK TYPE REACTORS/SUPERCONDUCTING MAGNETS**
ANL experimental program for pulsed superconducting coils, 3:22593 (CONF-771029-184)
Fast ramp superconductor for ohmic heating coils, 3:22592 (CONF-771029-180)
Mechanical design of ORPUS-3, 3:22591 (CONF-771029-149)
**TOKAMAK TYPE REACTORS/THERMONUCLEAR IGNITION**
Plasma engineering studies for the tokamak experimental power reactor, 3:22535 (CONF-771029-190)
**TOKAMAK TYPE REACTORS/WALL LOADING**
Wall load and lifetime goals for tokamak power plants, 3:22586
**TOLUENE/DEW POINT**
Dew-point loci for methane-toluene system, 3:21256 (CONF-770375-)
**TOLUENE/PYROLYSIS**
Study of the pyrolysis of toluene and phenols at low pressure, 3:20896
**TOROIDAL PINCH DEVICES/MAGNETIC FIELD CONFIGURATIONS**
Control of the formation of a compact toroidal structure with a pulsed barrier field, 3:22601 (UCRL-Trans-11290)
**TOROIDAL SCREW PINCH DEVICES/MATHEMATICAL MODELS**
Screw pinch approach to controlled fusion, 3:22454 (INIS-mf-3355)
**TOROIDAL THETA PINCH DEVICES/LASER IMPLOSIONS**
Thermonuclear fusion device LIME, 3:22568
**TOTAL ENERGY SYSTEMS**
Development of a total energy system for the Cedar Gap Christian Retreat Center (Combination of hydroelectric units on streams, wind generators, and solar thermal power plant with wood-burning boiler backup), 3:21707
**TOTAL ENERGY SYSTEMS/DEMONSTRATION PROGRAMS**
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 $ft^2$ knitwear plant), 3:21324 (ALO/3987-1/3)
**TOTAL ENERGY SYSTEMS/DESIGN**
Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report (24 facilities in 6 industry groups), 3:21325 (SAN/1132-2/4)
**TOTAL ENERGY SYSTEMS/EVALUATION**
State of the art for integrated Energy/Utility Systems, 3:21849 (PB-269684)
**TOTAL ENERGY SYSTEMS/PERFORMANCE**
HUD Utilities Demonstration Series. Volume 7. Performance analysis of the Jersey City total energy sits. Interim report, 3:21705 (PB-269517)
**TOTAL ENERGY SYSTEMS/SOLAR ENERGY**
Industrial applications of solar total energy. Volume IV. Catalog of first-level designs. Final report (24 facilities in 6 industry groups), 3:21325 (SAN/1132-2/4)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume II, Section 3. Facility concept design (1.72 MW thermal and 383.6 kW electric power for 42,000 $ft^2$ knitwear plant), 3:21323 (ALO/3987-1/2)
Solar Total Energy System, Large Scale Experiment, Shenandoah, Georgia. Final technical progress report. Volume III. Appendix (1.72 MW thermal and 383.6 kW electric power for 42,000 $ft^2$ knitwear plant), 3:21324 (ALO/3987-1/3)
**TOWER FOCUS POWER PLANTS/CENTRAL RECEIVERS**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem (10-MW Pilot Plant and 100-MW Commercial Plant), 3:21320 (SAN/1108-8/4)

Tower-type solar power plant: configuration and thermal-regime stability of receivers and steam generators, 3:21322
**TOWER FOCUS POWER PLANTS/DEMONSTRATION PLANTS**
Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108-8/2)
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem (10-MW Pilot Plant and 100-MW Commercial Plant), 3:21320 (SAN/1108-8/4)
**TOWER FOCUS POWER PLANTS/HELIOSTATS**
Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108-8/2)
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108-8/3)
**TOWER FOCUS POWER PLANTS/PILOT PLANTS**
Central Receiver Solar Thermal Power System, Phase 1. CDRL Item 2. Pilot Plant preliminary design report. Volume III, Book 1. Collector subsystem, 3:21318 (SAN/1108-8/2)
Central receiver solar thermal power system, Phase 1. CRDL Item 2. Pilot plant preliminary design report. Volume III, Book 2. Collector subsystem, 3:21319 (SAN/1108-8/3)
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume IV. Receiver subsystem (10-MW Pilot Plant and 100-MW Commercial Plant), 3:21320 (SAN/1108-8/4)
**TOWER FOCUS POWER PLANTS/TEST FACILITIES**
Georgia Tech Solar Thermal Test Facility, 3:21317
**TOWER FOCUS POWER PLANTS/THERMAL ENERGY STORAGE EQUIPMENT**
Central receiver solar thermal power system, Phase 1. CDRL Item 2. Pilot plant preliminary design report. Volume V. Thermal storage subsystem (Sensible heat storage using Caloria HT43 and mixture of gravel and sand), 3:21321 (SAN/1108-8/5)
**TRACK DETECTORS (DIELECTRIC)**
*See DIELECTRIC TRACK DETECTORS*
**TRAINING**
*See EDUCATION*
**TRAINS/USES**
Freight car management systems: a new way out of the car utilization dilemma, 3:21802
**TRANS 104 ELEMENTS/CHEMICAL PROPERTIES**
Chemistry of the transactinide elements, 3:22310
**TRANS 104 ELEMENTS/ISOTOPE PRODUCTION**
Chemistry of the transactinide elements, 3:22310
**TRANSDUCERS/DESIGN**
Instrumentation for the measurement of vibration in severe environments, such as nuclear reactors, 3:21612
**TRANSDUCERS/PERFORMANCE TESTING**
Displacement measurements at high temperatures with capacitive transducers ($CO_2$ cooled reactor), 3:21577
**TRANSFORMERS/COOLING**
Use of two-phase heat transfer for improved transformer cooling. Final report, 3:21530 (EPRI-EL-588)
**TRANSFORMERS/TEMPERATURE MONITORING**
Use of two-phase heat transfer for improved transformer cooling. Final report, 3:21530 (EPRI-EL-588)
**TRANSPORTATION SECTOR/ENERGY CONSERVATION**
Energy conservation competes with regulatory objectives for truckers: Interstate Commerce Commission. Report to the Congress, 3:21803 (PB-269746)
**TRANSPORTATION SECTOR/ENERGY CONSUMPTION**
Energy efficiency improvement target transportation equipment industry (SIC 37). Volume 1, 3:21798 (PB-270068)
Energy efficiency improvement targets for the transportation equipment industry (SIC 37). Volume 2. Industrial programs, conservation and environment. Target support document, 3:21799 (PB-270069)
Energy efficiency improvement targets for the transportation equipment industry(SIC 37). Volume 3. Final target document, 3:21800 (PB-270070)
**TRANSPORTATION SYSTEMS/AUTOMATION**
Flow-coordinated operating strategies for automated transportation systems, 3:21806
**TRANSPORTATION SYSTEMS/ENERGY CONSERVATION**
Second generation computer control procedures for dial-a-ride, 3:21805
**TRANSPORTATION SYSTEMS/OPERATION**
Flow-coordinated operating strategies for automated transportation systems, 3:21806
**TREES/ECOLOGY**
Old field vegetation as an inhibitor of tree vegetation, 3:22199
**TREES/INHIBITION**
Old field vegetation as an inhibitor of tree vegetation, 3:22199
**TREES/PLANT GROWTH**
Survival and dry matter production of some high-yield clones of SALIX and POPULUS selected for forest industry and energy production. Pilot study, 3:21259 (SHS-IFSY-RU-3)
**TRIBUTYL PHOSPHATE**
*See TBP*
**TRIHYDROXYAROMATICS**
*See POLYPHENOLS*
**TRIOXANES/CRYSTAL STRUCTURE**
Studies of the surface structures of molecular crystals and of adsorbed molecular monolayers on the (111) crystal faces of platinum and silver by low-energy electron diffraction, 3:22312 (LBL-6017)
**TRITIUM/BREEDING**
Chemical aspects of controlled thermonuclear synthesis problem. Review, 3:22629
Cost of tritium bred in a critical fission reactor, 3:22628
**TRITIUM/BREEDING RATIO**
Physics of tritium breeding as a geometric programming problem, 3:22630 (WFPS-TME-068)
**TRITIUM COMPOUNDS/MEMBRANE TRANSPORT**
Placental transport of radionuclides. Terminal report, May 1, 1973-July 31, 1975 (Tritiated water, tritium, $^{14}C$, $^{45}C$, and $^{47}C$ tracers), 3:22268 (COO-2363-4)
**TRITIUM RECOVERY**
Chemical aspects of controlled thermonuclear synthesis problem. Review, 3:22629
**TRITONS/DIFFUSION**
Diffusion of light particles in metals, 3:22392
**TROPOSPHERE/MIXING**
Measurement of airborne radioactivity and its meteorolgical application. Part VI. Annual report, 1 August 1974-31 July 1975, 3:22191 (NYO-3425-14)
**TRUCKS/DIESEL ENGINES**
Energy usage and other comparisons between gasoline and diesel medium duty trucks, 3:21852
**TRUCKS/ENERGY CONSERVATION**
Energy conservation competes with regulatory objectives for truckers: Interstate Commerce Commission. Report to the Congress, 3:21803 (PB-269746)
**TRUCKS/SPARK IGNITION ENGINES**
Energy usage and other comparisons between gasoline and diesel medium duty trucks, 3:21852
**TUBES**
*(For objects of tubular shape; not for DRIFT TUBES, ELECTRON TUBES or IMAGE STORAGE TUBES.)*
**TUBES/FABRICATION**
Production and testing of tubes for nuclear boiler steam generators (PWR), 3:21566
**TUBES/NONDESTRUCTIVE TESTING**
Production and testing of tubes for nuclear boiler steam generators (PWR), 3:21566
**TUMOR CELLS/BIOLOGICAL RADIATION EFFECTS**
Analysis of animal experiments of radiation dependent tumor regression in relation to different parameters, 3:22261 (LA-tr-77-73A)
**TUMOR CELLS/CELL PROLIFERATION**
Analysis of animal experiments of radiation dependent tumor regression in relation to different parameters, 3:22261 (LA-tr-77-73A)
**TUMOR CELLS/CYTOLOGICAL TECHNIQUES**
Impulse cytophotometric studies on tumor material, 3:22234 (LA-tr-77-88)
**TUMOR CELLS/CYTOLOGY**
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr-77-86)
**TUMOR CELLS/PHOTOMETRY**
Continuous-flow fluorometry of ovarian carcinoma with and without effusions, 3:22237 (LA-tr-77-86)
**TUMOR VIRUSES**
*See ONCOGENIC VIRUSES*
**TUMORS**
*See NEOPLASMS*
**TUNGSTEN/COMPRESSIBILITY**
Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**TUNGSTEN/PROTON REACTIONS**
Polarization of prompt muons produced at large transverse momenta (2815 GeV), 3:22331
**TUNGSTEN/SELF-DIFFUSION**
Anomalous diffusion in bcc metals of the 5th and 6th groups (Mo, Nb, Ta, W), 3:21891
**TUNGSTEN 182/ENERGY LEVELS**
Coulomb excitation of $^{182\ 184\ 186}W$ and $^{166}Er$ with $^{4}He$ and $^{16}O$ ions, 3:22370
**TUNGSTEN 182 TARGET/ALPHA REACTIONS**
Coulomb excitation of $^{182\ 184\ 186}W$ and $^{166}Er$ with $^{4}He$ and $^{16}O$ ions, 3:22370

**TUNGSTEN 184/ENERGY LEVELS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**TUNGSTEN 184 TARGET/ALPHA REACTIONS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**TUNGSTEN 186/ENERGY LEVELS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**TUNGSTEN 186 TARGET/ALPHA REACTIONS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**TUNGSTEN 186 TARGET/OXYGEN 16 REACTIONS**
Coulomb excitation of $^{182\ 184\ 186}$W and $^{166}$Er with $^{4}$He and $^{16}$O ions, 3:22370
**TUNGSTEN COMPLEXES/CHEMICAL PREPARATION**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**TUNGSTEN COMPLEXES/CRYSTAL STRUCTURE**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**TUNGSTEN COMPLEXES/MAGNETIC SUSCEPTIBILITY**
Synthesis and structure of bis(tetrapropylammonium) tri-μ-bromo-hexabromoditungstate(2-). A novel odd-electron dimeric anion showing evidence of Jahn-Teller distortion, 3:21952
**TURBINE BLADES/AERODYNAMICS**
Effect of aerofoil characteristics on windmill performance, 3:21462
**TURBINE BLADES/MECHANICAL VIBRATIONS**
Analysis of nonstationary processes in saturated steam turbine flow-through sections, 3:21503
Determination on a static model of the stiffness factor of the transverse circulation force in steam turbines, 3:21506
**TURBINE BLADES/MOISTURE**
Formation of coarsely dispersed moisture on the trailing edges of nozzle rings of saturated steam turbines, 3:21504
**TURBINES**
*See also GAS TURBINES*
*HYDRAULIC TURBINES*
*STEAM TURBINES*
**TURBINES/BEARINGS**
Segmental radial bearings for high-capacity turbines, 3:21490
**TURBINES/DESIGN**
Method of optimal design of axial turbine stages, 3:21491
**TURBOGENERATORS**
*See also HYDRAULIC TURBINES*
**TURBOGENERATORS/MODIFICATIONS**
Power production at Federal dams could be increased by modernizing turbines and generators, 3:21266 (PB-269254)
**TURBOMACHINERY**
*See also PUMPS*
*TURBINES*
**TURBOMACHINERY/CONSTRUCTION**
Extension of the power plant mehrum by an additional 700 MW unit, 3:21487
**TURBOMACHINERY/UNSTEADY FLOW**
Profile losses in unsteady flow past active rotor blades, 3:21505
**TURBULENT FLOW/CHEMICAL REACTIONS**
Modeling complex chemical reactions in flows with turbulent, diffusive mixing, 3:22068 (UCRL-79770)
**TURBULENT HEATING/CYCLOTRON RADIATION**
Observations of cyclotron radiations from turbulently heated plasmas (the MACH II), 3:22407
**TWO-PHASE FLOW/VOID FRACTION**
Local properties of vertical mercury-argon two-phase flow in a circular tube under transverse magnetic field (Thermonuclear Reactor Cooling Systems), 3:22609
**TWO-STREAM INSTABILITY/ION PLASMA WAVES**
Self-oscillations excited by two stream ion-ion instability, 3:22490
**TWO-STREAM INSTABILITY/LARMOR RADIUS**
Influence of finite ion Larmor radius effects on the ion resonance instability in a nonneutral plasma column, 3:22480
**TYPE-II SUPERCONDUCTORS/MIXED STATE**
Strength of an ideal vortex lattice in a superconductor, 3:22398
**TYPE-II SUPERCONDUCTORS/STRESS ANALYSIS**
Viscous drag on mobile dislocations in type-II superconductors, 3:21886
**TYPE-III SUPERCONDUCTORS**
*See TYPE-II SUPERCONDUCTORS*

## U

**UHV AC SYSTEMS/GAS-INSULATED CABLES**
Study of gas dielectrics for cable insulation. Final report, 3:21549 (EPRI-EL-220)
**ULTRACOLD NEUTRONS/STORAGE**
Proposed neutron bottle for the Argonne pulsed neutron source and its application in the search for the neutron electric dipole moment, 3:22119 (ORO-2504-267)
**ULTRAVIOLET RADIATION/BIOLOGICAL RADIATION EFFECTS**
Basic aspects of radiation action on microorganisms. Final report for the period ending October 31, 1977 (Radioresistance of micrococcus luteus), 3:22252 (COO-2362-27)
**ULTRAVIOLET RADIATION/MEETINGS**
Second international and winter school on submillimeter waves and their applications, 3:22067
**UNDERGROUND HEAT DISTRIBUTION SYSTEMS**
*See HEAT DISTRIBUTION SYSTEMS*
**UNDERGROUND MINING**
*See also LONGWALL MINING*
**UNDERGROUND MINING/HYDRAULIC TRANSPORT**
Hydraulic hoisting of crushed ores. A feasibility study and pilot-plant investigation on coarse iron ore transportation by centrifugal pumps, 3:22015 (STU-75-5234)
**UNDERGROUND MINING/INFORMATION**
XIV APCOM symposium, preprints, 3:21690 (CONF-761061-)
**UNDERGROUND MINING/MINING EQUIPMENT**
$NO_2$ levels in diesel exhaust, 3:22090 (BERC/TPR-78/1)
**UNDERGROUND MINING/SAFETY**
Time-dependent strain in rocks and its significance in mining, 3:22091
**UNDERGROUND POWER TRANSMISSION/GAS-INSULATED CABLES**
Welded pipe line system, insulated by sulfur hexafluoride, made of an aluminium alloy, for power transmission, 3:21533
**UNICELLULAR ALGAE/CULTIVATION**
Cultivation on sewage of microalgae harvestable by microstrainers. Progress report, 3:21311 (TID-27702)
**UNICELLULAR ALGAE/HARVESTING**
Cultivation on sewage of microalgae harvestable by microstrainers. Progress report, 3:21311 (TID-27702)
**UNITED KINGDOM/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**UNITED KINGDOM/OIL SPILLS**
Oil pollution control officer training course, 3:21030
**UNITED KINGDOM/POLLUTION LAWS**
Oil pollution of inland waters in England and Wales, 3:21023
**UNITED STATES OF AMERICA**
*See USA*
**URANIUM/ATOM-MOLECULE COLLISIONS**
Uranium atoms and ions in the gas phase. Progress report, March 1, 1977-February 28, 1978, 3:21141 (COO/4295-1)
**URANIUM/BODY BURDEN**
Migration of uranium from the environment into a human being, 3:22279 (ORNL-tr-4551)
**URANIUM/DAUGHTER PRODUCTS**
Continuous working level monitor (Radon daughters in uranium mine air), 3:22175 (HASL-325)
**URANIUM/ENVIRONMENTAL TRANSPORT**
Migration of uranium from the environment into a human being, 3:22279 (ORNL-tr-4551)
**URANIUM/FORECASTING**
Uranium supply to 2000, Canada and the world, 3:21164 (MR-168)
**URANIUM/HEALTH HAZARDS**
Radon/radon-daughter measurement methods and instrumentation (Radiation monitoring of uranium mines and mills), 3:22164 (HASL-325)
**URANIUM/LASER ISOTOPE SEPARATION**
Photoionization of uranium atoms by an argon ion laser, 3:22315
**URANIUM/MARKET**
Uranium, 3:21134
**URANIUM/MILL TAILINGS**
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT-20)
**URANIUM/MILLING**
Comparison of costs of integrating working level devices (Radon monitoring), 3:22173 (HASL-325)

Instrumentation use in the uranium mill tailings program in Colorado, 3:22182 (HASL-325)
Radiation surveys in contaminated communities (Uranium contamination), 3:22179 (HASL-325)
Radon/radon-daughter measurement methods and instrumentation (Radiation monitoring of uranium mines and mills), 3:22164 (HASL-325)
URANIUM/NUCLEAR REACTION ANALYSIS
Uranium analysis of natural waters by fission tracks, 3:21926
URANIUM/PHOTOIONIZATION
Photoionization of uranium atoms by an argon ion laser, 3:22315
URANIUM/QUANTITATIVE CHEMICAL ANALYSIS
Lunar sample studies, 3:21917 (N-77-27053)
URANIUM/RADIATION MONITORING
Instrumentation use in the uranium mill tailings program in Colorado, 3:22182 (HASL-325)
Radiation surveys in contaminated communities (Uranium contamination), 3:22179 (HASL-325)
URANIUM/RADIOACTIVE WASTE MANAGEMENT
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Phase II, Title I, 3:22160 (GJT-18)
Engineering assessment of inactive uranium mill tailings, Lakeview Site, Lakeview, Oregon. Summary of Phase II, Title I, 3:22161 (GJT-18S)
Engineering assessment of inactive uranium mill tailings, Ray Point Site, Ray Point, Texas. Phase II, Title I, 3:22162 (GJT-20)
URANIUM/RADIOMETRIC ANALYSIS
Method and apparatus for determining uranium concentration in a moving stream, 3:21933
URANIUM/SCINTILLATION COUNTING
Uranium assay of phosphate fertilizers and other phosphatic materials, 3:21941
URANIUM/SEPARATION PROCESSES
Method to recover uranium from uranium-containing phosphate ores (Patent), 3:21138
URANIUM/X-RAY FLUORESCENCE ANALYSIS
Radioisotopic x-ray analysis of uranium ores using Compton scatter for matrix compensation, 3:21934
URANIUM 227/NUCLEAR STRUCTURE
Nuclear data sheets for A=227, 3:22377
URANIUM 233/TOXICITY
Relative occupational risks of plutonium and $^{233}U$ fuels, 3:22266
URANIUM 233 TARGET/NEUTRON REACTIONS
Delayed neutron spectra from $^{232}Th$, $^{233}U$, $^{235}U$, and $^{239}Pu$, 3:22379 (RLO/2225/T3-6)
URANIUM 235/CRITICALITY
Pulsed reactivity measurements of large $^{235}U$-Al castings in $H_2O$, 3:22011 (DP-MS-77-49)
URANIUM 235/STORAGE
Pulsed reactivity measurements of large $^{235}U$-Al castings in $H_2O$, 3:22011 (DP-MS-77-49)
URANIUM 235 TARGET/NEUTRON REACTIONS
Delayed neutron spectra from $^{232}Th$, $^{233}U$, $^{235}U$, and $^{239}Pu$, 3:22379 (RLO/2225/T3-6)
Review of microscopic integral cross section data in fundamental reactor dosimetry benchmark neutron fields, 3:22378 (HEDL-SA-1148(Rev.1))
URANIUM 238 TARGET/NEUTRON REACTIONS
Delayed neutron spectra from $^{232}Th$, $^{233}U$, $^{235}U$, and $^{239}Pu$, 3:22379 (RLO/2225/T3-6)
URANIUM CARBIDES/BURNUP
Study of uranium-plutonium carbide-based fuel simulating high burnup, 3:21150
URANIUM CARBIDES/TEMPERATURE GRADIENTS
Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient, 3:21149
URANIUM COMPOUNDS/ABSORPTION SPECTRA
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
URANIUM COMPOUNDS/CHEMICAL PREPARATION
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
URANIUM COMPOUNDS/MAGNETIC RESONANCE
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
URANIUM COMPOUNDS/MAGNETIC SUSCEPTIBILITY
Syntheses and optical and magnetic properties of tetrakis(di-n-propylamido)uranium(IV), tetrakis(di-n-butylamido)uranium(IV), tetrakis(di-n-propylamido)thorium(IV), and tetrakis(di-n-butylamido)thorium(IV), volatile liquid amides, 3:21996
URANIUM DEPOSITS/AUTORADIOGRAPHY
Alpha-particle autoradiography of geological specimens by use of cellulose nitrate detectors, 3:21132
URANIUM DEPOSITS/DEPOSITION
Mechanism of strata infiltration ore deposition, 3:21117
URANIUM DEPOSITS/EXPLORATION
Alpha-particle autoradiography of geological specimens by use of cellulose nitrate detectors, 3:21132
Central ore dressing plant possible as Karoo uranium prospecting builds up, 3:21126
Field surveys using a portable gamma ray scintillometer, 3:21128
Mobile helium sniffer for petroleum, uranium and geothermal prospecting, 3:21136
Preliminary study of the uranium favorability of granitic and contact-metamorphic rocks of the Owens Valley area, Inyo and Mono Counties, California, and Esmeralda and Mineral Counties, Nevada, 3:21120 (GJBX-3(78))
Preliminary study of uranium favorability of the Wilcox and Claiborne Groups (Eocene) in Texas, 3:21121 (GJBX-7(78))
Reconnaissance-level geochemical and radiometric exploration data from the vicinity of the Rabbit Lake uranium deposit, 3:21129
Savannah River Laboratory Hydrogeochemical and Stream Sediment Reconnaissance. Preliminary raw data release: Spartanburg 1° x 2° NTMS area, North Carolina and South Carolina. National Uranium Resource Evaluation Program, 3:21118 (DPST-77-146-2)
State may assist in making small Karoo uranium deposits viable, 3:21127
Uranium, 3:21134
Uranium mill monitoring for natural fission reactors, 3:21109 (LA-7062-MS)
URANIUM DEPOSITS/GEOCHEMICAL SURVEYS
Geochemical exploration for uranium in the Grenville province of Ontario, 3:21130
Geochemical methods applied to uranium exploration in southwest Baffin Island, 3:21131
National Uranium Resource Evaluation Program. Hydrogeochemical and Stream Sediment Reconnaissance Program in Central United States. Fourth quarter FY-1977, July 1-September 30, 1977, 3:21125 (K/UR-3(Pt.5))
Radioactive halos as possible indicators for geochemical processes in magmatites, 3:21135
Reconnaissance-level geochemical and radiometric exploration data from the vicinity of the Rabbit Lake uranium deposit, 3:21129
URANIUM DEPOSITS/GEOCHEMISTRY
Distribution of clark uranium in terrigenous strata of Lower Carbonic period in the limits of the Orenburg region, 3:21116
URANIUM DEPOSITS/GEOLOGY
Mode of uranium occurrence in a migmatitic granite terrain, Baie Johan Beetz, Quebec, 3:21114
URANIUM DEPOSITS/GLOBAL ASPECTS
New types of deposits will provide future supplies of uranium, 3:21115
URANIUM DEPOSITS/MINERALIZATION
Blind River uranium deposits: the ores and their setting, 3:21110 (MP-65)
URANIUM DEPOSITS/ORIGIN
Changing ideas on metallogenesis of Saskatchewan's uranium deposits, 3:21113
URANIUM DEPOSITS/PROSPECTING
Field manual for stream water and sediment reconnaissance, 3:21119 (DPST-77-363)
Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX-78(77))
Preliminary study of favorability for uranium of the Sangre de Cristo Formation in the Las Vegas basin, northeastern New Mexico, 3:21123 (GJBX-82(77))
Preliminary study of the uranium favorability of tertiary rocks, southeastern Oregon: eastern Klamath, Southern Lake, Harney, and western Malheur Counties, 3:21124 (GJBX-92(77))
Prospects for uranium exploration on a national scale (Belgium), 3:21133
URANIUM DIOXIDE/CRITICALITY
Basis for subcritical limits in proposed criticality safety standard for mixed oxides, 3:21215
URANIUM DIOXIDE/FLUORINATION
Molecular beam study of the kinetics of the fluorine-uranium dioxide reaction, 3:21998
URANIUM DIOXIDE/SPECTROSCOPY
Measurements of energy dependent Doppler factor for uranium dioxide using a lead slowing-down time spectrometer, 3:21146

**URANIUM DIOXIDE/THERMAL CONDUCTIVITY**
Experimental determination of thermal conductivity coefficient of $UO_2$ and fuel cladding contact conduction in fuel elements under reactor irradiation, 3:21902 (NIIAR-P-250)
**URANIUM HEXAFLUORIDE**
In-line gas chromatograph for analysis of $UF_6$ and/or $F_2$, 3:21159
**URANIUM ISOTOPES/ISOTOPE SEPARATION**
Method for separation and enrichment of isotopes (Patent), 3:21142
Uranium atoms and ions in the gas phase. Progress report, March 1, 1977-February 28, 1978, 3:21141 (COO/4295-1)
**URANIUM ISOTOPES/LASER ISOTOPE SEPARATION**
Laser isotope separation, 3:21143
**URANIUM ISOTOPES/SPONTANEOUS FISSION**
Spontaneously fissioning isomers, 3:22375
**URANIUM MINES/AIR SAMPLERS**
3R-WL air sampling survey meter (Uranium mine air monitor), 3:22171 (HASL-325)
**URANIUM MINES/HEALTH HAZARDS**
Radiation surveys in contaminated communities (Uranium contamination), 3:22179 (HASL-325)
**URANIUM MINES/RADIATION HAZARDS**
Exposure to radon daughters and the incidence of lung cancer, 3:22256
Uranium mine radon control research, 3:21216
**URANIUM MINES/RADIATION MONITORING**
Continuous working level monitor (Radon daughters in uranium mine air), 3:22175 (HASL-325)
Radon/radon-daughter measurement methods and instrumentation (Radiation monitoring of uranium mines and mills), 3:22164 (HASL-325)
Some remarks on exact methods for WL and $^{222}Rn$-daughter determination (Monitoring working level radioactivity in uranium mines), 3:22172 (HASL-325)
**URANIUM NITRIDES/ANTIFERROMAGNETISM**
Uranium nitride: a cubic antiferromagnet with anisotropic critical behavior, 3:21901 (CONF-771080-2)
**URANIUM NITRIDES/TEMPERATURE GRADIENTS**
Simulation study of the restructuring of advanced fuel heated in a radial temperature gradient, 3:21149
**URANIUM ORES/ISOTOPE RATIO**
Uranium mill monitoring for natural fission reactors, 3:21109 (LA-7062-MS)
**URANIUM ORES/ORE PROCESSING**
Radiological criteria for the phase II inactive mill tailings program, 3:21207
Radiological effluent and environmental monitoring for uranium mills: a regulatory viewpoint, 3:22197
Releases of radioactivity from uranium mills and radwaste effluent costs, 3:21206
Summary of the Phase II, Title I, engineering assessment of inactive uranium mill tailings, Gunnison Site, Gunnison, Colorado, 3:21201 (GJT-125)
Uranium, 3:21134
Uranium ore crushing, 3:21137
Uranium recovery trials at Risoe, 3:21994
**URANIUM ORES/X-RAY FLUORESCENCE ANALYSIS**
Radioisotopic x-ray analysis of uranium ores using Compton scatter for matrix compensation, 3:21934
**URANIUM OXIDES**
*See also URANIUM DIOXIDE*
*URANIUM TRIOXIDE*
**URANIUM OXIDES/FLUORINATION**
In-line gas chromatograph for analysis of $UF_6$ and/or $F_2$, 3:21159
**URANIUM OXIDES/ION-MOLECULE COLLISIONS**
Uranium atoms and ions in the gas phase. Progress report, March 1, 1977-February 28, 1978, 3:21141 (COO/4295-1)
**URANIUM RESERVES**
Ford foundation report 'too optimistic' on US uranium supplies, 3:21112
Recent development of the process and mineral industries in Australia, 3:21111
**URANIUM TRIOXIDE/PRODUCTION**
Explosion and fire during conversion of liquid uranyl nitrate to solid uranium oxide, 3:21212
**URANYL COMPLEXES/CRYSTAL STRUCTURE**
Structure of uranyl nitrate-bis(tetrahydrofuan), 3:21995
**URANYL NITRATES/ADSORPTION**
Reaction of uranyl nitrate solutions with amberlite IRC-72 cation exchange resin at 30°C: a kinetic investigation for the HTGR fuel recycle plant, 3:21152 (ORNL/TM-5866)
**URANYL NITRATES/CHEMICAL REACTION KINETICS**
Reaction of uranyl nitrate solutions with amberlite IRC-72 cation exchange resin at 30°C: a kinetic investigation for the HTGR fuel recycle plant, 3:21152 (ORNL/TM-5866)
**URANYL NITRATES/DENITRATION**
Explosion and fire during conversion of liquid uranyl nitrate to solid uranium oxide, 3:21212
**US BUREAU OF MINES/RESEARCH PROGRAMS**
Bureau of Mines research 1976: a summary of significant results in mining, metallurgy, and mineral economics, 3:21697
**US DOE/BUDGETS**
Environmental control technology activities of the Department of Energy in FY 1977, 3:22230 (DOE/EV-0030)
**US DOE/RESEARCH PROGRAMS**
Environmental control technology activities of the Department of Energy in FY 1977, 3:22230 (DOE/EV-0030)
**US ERDA/RESEARCH PROGRAMS**
Fossil energy research meeting, 3:20841 (CONF-7706100-)
**USA**
*See also ALASKA*
*ARIZONA*
*CALIFORNIA*
*COLORADO*
*GEORGIA*
*ILLINOIS*
*MARYLAND*
*MISSOURI*
*NEVADA*
*NEW JERSEY*
*NEW MEXICO*
*NEW YORK*
*NORTH CAROLINA*
*NORTH DAKOTA*
*OREGON*
*SOUTH CAROLINA*
*TEXAS*
*UTAH*
*WASHINGTON*
*WEST VIRGINIA*
*WYOMING*
**USA/CLIMATES**
Impacts of the western drought on the regional electricity situation (Pacific Northwest), 3:21743 (TID-28064)
**USA/ELECTRIC POWER**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
Impacts of the western drought on the regional electricity situation (Pacific Northwest), 3:21743 (TID-28064)
**USA/ENERGY SOURCE DEVELOPMENT**
Outlook for utility development of geothermal resources, 3:21392
**USA/ENERGY SOURCES**
Energetics of the United States of America: an atlas (By county), 3:21677 (BNL-50501-R)
**USA/ENERGY SUPPLIES**
Energy emergency planning guide: Winter 1977-78, 3:21714 (DOE/ERA-0031)
Suggestions for a Phase-II national energy policy. Final report, March 1977-September 1977, 3:21723 (FE/2660-1)
**USA/GEOTHERMAL ENERGY**
Recent developments in geothermal energy, 3:21438
**USA/INSOLATION**
Hourly solar radiation data for vertical and horizontal surfaces on average days in the United States and Canada (80 locations), 3:21267 (NBS-BSS-96)
**USA/NATURAL GAS DEPOSITS**
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G-77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G-77/357)
**USA/PETROLEUM DEPOSITS**
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G-77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G-77/357)
**USA/URANIUM RESERVES**
Ford foundation report 'too optimistic' on US uranium supplies, 3:21112
**USSR/ENERGY CONSUMPTION**
On certain patterns in the development of the energy balance of the USSR, 3:21722
**USSR/ENERGY DEMAND**
On certain patterns in the development of the energy balance of the USSR, 3:21722
**USSR/ENERGY POLICY**
World Energy Conference reveals Soviet energy strategy, 3:21693
**USSR/ENERGY SOURCE DEVELOPMENT**
World Energy Conference reveals Soviet energy strategy, 3:21693
**USSR/HEAT FLOW**
Characteristics of geothermal conditions of the northern near-Boart zone of the Dnieper-Donets depression, 3:21453
**USSR/NATURAL GAS DEPOSITS**
Influence of hydrate formation on the information content of indicators of oil-bearing and gas-bearing potential, 3:20941
Results and effectiveness of gas prospecting operations in the main areas of the western Precaucasus, 3:21062

**USSR/NATURAL RADIOACTIVITY**
Natural radioactivity of some soils in landscapes of the kolochnaya forest-steppe of the Tambov region, 3:22203 (ORNL-tr-4518)
**USSR/PETROLEUM DEPOSITS**
Influence of hydrate formation on the information content of indicators of oil-bearing and gas-bearing potential, 3:20941
**UTAH/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**UTAH/ENERGY CONSERVATION**
Home energy savers program: a little time can save a lot of money, 3:21709 (TID-28047)
Proposed program for energy conservation in Utah, 3:21712
**UTAH/ENERGY POLICY**
Proposed program for energy conservation in Utah, 3:21712
**UTAH/RADIOACTIVE WASTE STORAGE**
Subsurface geology of a potential waste emplacement site, Salt Valley Anticline, Grand County, Utah, 3:21183 (USGS-OFR-77-761)
**UTAH/URANIUM DEPOSITS**
Preliminary study of the uranium potential of Tertiary rocks in the central San Juan Basin, New Mexico, 3:21122 (GJBX-78(77))
**UTERUS/CARCINOMAS**
Impulse cytophotometric and repeated cytologic examinations of cervical secretions as compared with histologic findings, 3:22235 (LA-tr-77-87)

## V

**VACUUM COATING**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**VALVES**
Report of survey of valve industry capabilities, 3:20849 (CONF-771145-2)
**VALVES/DESIGN**
Coal gasification valves, Phase II. Quarterly technical progress report, June 1977-August 1977 (High temperature), 3:20856 (FE-2355-2(Rev.D))
**VALVES/MATERIALS TESTING**
Coal gasification valves, Phase II. Quarterly technical progress report, June 1977-August 1977 (High temperature), 3:20856 (FE-2355-2(Rev.D))
**VALVES/PERFORMANCE TESTING**
Low-noise control valve. II, 3:22607 (CONF-771029-153)
**VALVES/RELIABILITY**
Operating experience with amine absorber level control valves, 3:21076 (CONF-7603113-)
**VAN DE GRAAFF ACCELERATORS/DESIGN**
High voltage particle accelerator utilizing polycrystalline ferroelectric ceramic material (Patent), 3:22102
**VANADIUM/COMPRESSIBILITY**
Isothermal compression of bcc transition metals to 100 kbar, 3:21879
**VANADIUM/CORROSION**
Corrosion resistance of vanadium and vanadium alloys as structural materials in a lithium cooled fusion reactor, 3:21893
**VANADIUM/ELECTRON-PHONON COUPLING**
Comparative study of electron-phonon interaction in three vanadium samples of varying purity. Interim report1 October 1973-30 September 1975, 3:21880 (AD-A-042702)
**VANADIUM/PERMEABILITY**
Electromigration of hydrogen and deuterium in vanadium, niobium, and tantalum, 3:21881 (IS-T-778)
**VANADIUM/X-RAY FLUORESCENCE ANALYSIS**
Rapid simultaneous determination of sulfur and vanadium in crude oil using X-ray fluorescence, 3:21932
**VANADIUM ALLOYS**
*See also VANADIUM BASE ALLOYS*
**VANADIUM ALLOYS/PROTECTIVE COATINGS**
Wear resistant coatings for titanium alloys. Final report 15 March 1976-15 March 1977 (Cr-Mo coating on Ti-8Al-1V-1Mo substrate), 3:21872 (AD-A-042443)
**VANADIUM BASE ALLOYS/CHEMICAL PREPARATION**
Solid-state (bronze process) $V_3Ga$ from a V-Al alloy core, 3:21885
**VANADIUM BASE ALLOYS/CORROSION**
Corrosion resistance of vanadium and vanadium alloys as structural materials in a lithium cooled fusion reactor, 3:21893
**VANADIUM BASE ALLOYS/SUPERCONDUCTIVITY**
Solid-state (bronze process) $V_3Ga$ from a V-Al alloy core, 3:21885
**VANADIUM COMPLEXES/CHEMICAL BONDS**
Transition metal ion binding by ferritin as studied by electron paramagnetic resonance spectroscopy (Ferric, manganous, cuprous, cupric, and vanadyl ion binding), 3:21976 (LBL-6682)
**VANADIUM COMPOUNDS/EXTRACTION**
Phase state of ash remainders of residual fuel oil, 3:21844
**VANADIUM OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**VANPOOLING/OPTIMIZATION**
Second generation computer control procedures for dial-a-ride, 3:21805
**VAPOR INCINERATORS**
*See AFTERBURNERS*
**VECTOR MESONS**
*(Mesons with spin-one.)*
**VECTOR MESONS/DECAY**
$Q_1(1290)$ and $Q_2(1400)$ decay rates and their SU(3) implications (Rates), 3:22351
**VEGETATION**
*See PLANTS*
**VEHICLES**
*See also AUTOMOBILES*
*ELECTRIC-POWERED VEHICLES*
*HYBRID ELECTRIC-POWERED VEHICLES*
*TRUCKS*
**VEHICLES/INTERNAL COMBUSTION ENGINES**
Method and device for the conversion of heat into mechanical energy (Patent), 3:21851
**VEHICLES/TEST FACILITIES**
Speed, acceleration, and pulse prediction calculations on test vehicles with wheel pulse generators, 3:21859 (SAND-78-0030C)
**VENTILATION/MEASURING METHODS**
Ventilation measurements as an adjunct to radon measurements in buildings, 3:22190 (HASL-325)
**VENUS PLANET/CLOUDS**
Clouds of Venus, 3:22305
**VENUS PLANET/EXPLORATION**
Exploration of Venus, 3:22302
**VENUS PLANET/PIONEER SPACE PROBES**
Pioneer Venus program, 3:22304
**VENUS PLANET/PLANETARY ATMOSPHERES**
Dynamics, winds, circulation and turbulence in the atmosphere of Venus, 3:22303
**VESSELS**
*See CONTAINERS*
**VESSELS (PRESSURE)**
*See PRESSURE VESSELS*
**VETCH**
*See VICIA*
**VICIA/BIOLOGICAL RADIATION EFFECTS**
Determination of Relative Biological Efficacy (RBE) and Oxygen Enhancement Ratio (OER) for the entire negative and positive pion beam profile using Vicia faba roots and Drosophila embryos as biological model systems, 3:22253 (LA-tr-77-75)
**VIRUSES**
*See also ONCOGENIC VIRUSES*
**VIRUSES/MOSAICISM**
Translation of the RNAs of brome mosaic virus: the monocistronic nature of RNA1 and RNA2, 3:22231
**VISIBLE RADIATION/MEETINGS**
Second international and winter school on submillimeter waves and their applications, 3:22067
**VOLOXIDATION PROCESS**
*(Separation process designed to remove volatile fission products from spent LMFBR fuels.)*
**VOLOXIDATION PROCESS/RESEARCH PROGRAMS**
Advanced fuel recycle program progress report, July 1-September 30, 1977, 3:21153 (ORNL/TM-6092)
**VRAIN REACTOR/FUEL CYCLE**
Low-enrichment and mid-enrichment denatured (thorium) fuels for the HTGR: a feasibility study. Final report, 3:21573 (GA-A-14684)

## W

**WAIRAKEI GEOTHERMAL FIELD/ENVIRONMENTAL EFFECTS**
Environmental aspects of geothermal energy, 3:21434
**WANKEL ENGINES/EXHAUST GASES**
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine, 3:21854 (N-77-26134)

**WANKEL ENGINES/PERFORMANCE TESTING**
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine, 3:21854 (N-77-26134)
**WASHINGTON/ELECTRIC UTILITIES**
Energy management seminar (Seattle City Light's attempt to assist customers in energy efficiency), 3:21710
**WASTE HEAT/HEAT RECOVERY**
Combined gas/steam-turbine power station belonging to the Stadtwerke Saarbruecken AG, 3:21519
Heat recovery equipment for engines, 3:21847 (ANL/CES/TE-77-4)
**WASTE HEAT UTILIZATION**
[Energy conservation methods used in French industry], 3:21839 (DOE-tr-45)
Installation permitting the recuperation of heat from waste water and the saving of water (Patent), 3:21780
**WASTE OILS/MAXIMUM PERMISSIBLE CONCENTRATION**
Determination of an oil effluent guideline for industrial discharges in the state of New Jersey: is 1 ppM realistic and obtainable, 3:21026
**WASTE OILS/MONITORING**
Photomicrograph techniques for characterization and monitoring oily waste streams, 3:21033
**WASTE OILS/PHOTOMICROGRAPHY**
Photomicrograph techniques for characterization and monitoring oily waste streams, 3:21033
**WASTE OILS/SOLIDIFICATION**
Method of converting oil and waste containing sludge to dry waste (Patent), 3:21005
**WASTE PROCESSING**
*See also ACTIVATED SLUDGE PROCESS*
*ANAEROBIC DIGESTION*
*RADIOACTIVE WASTE PROCESSING*
**WASTE PROCESSING/SOLAR HEATING**
Solar powered anaerobic wastewater treatment plant, 3:21361
**WASTE PROCESSING/WASTE PROCESSING PLANTS**
Positive uses of mill tailings, 3:21843
**WASTE PROCESSING PLANTS/ECONOMICS**
No tipping: service included in waste burning plant, 3:22083
**WASTE PROCESSING PLANTS/EQUIPMENT**
Facility deficiencies, 3:22082 (CONF-770235-)
**WASTE PROCESSING PLANTS/OPERATION**
No tipping: service included in waste burning plant, 3:22083
**WASTE SOLUTIONS**
*See LIQUID WASTES*
**WASTE WATER/ACTIVATED SLUDGE PROCESS**
Treatment of wastewaters from succinimide additive production unit at Perm' Petroleum Refinery, 3:21011
**WASTE WATER/DENITRIFICATION**
Continuous fixed-film denitrification of high-strength industrial nitrate wastes, 3:21845
**WASTE WATER/FILTRATION**
Experience in the use of polyurethane foam as a filter material in treating oil-containing wastewaters, 3:21014
**WASTE WATER/HEAT RECOVERY**
Heat recovery from domestic waste water, 3:21792
Installation permitting the recuperation of heat from waste water and the saving of water (Patent), 3:21780
**WASTE WATER/MONITORING**
Photomicrograph techniques for characterization and monitoring oily waste streams, 3:21033
**WASTE WATER/OXIDATION**
Kinetics of biochemical oxidation of refinery wastewaters, 3:21008
Use of ozone in treatment and aftertreatment of refinery wastewaters, 3:21012
**WASTE WATER/PHOTOMICROGRAPHY**
Photomicrograph techniques for characterization and monitoring oily waste streams, 3:21033
**WASTE WATER/QUANTITATIVE CHEMICAL ANALYSIS**
Gas chromatographic method for determination of content of petroleum sulfones in wastewaters, 3:21018
**WASTE WATER/WASTE PROCESSING**
Concentrating waste streams from electric desalting units by means of contact evaporators, 3:21016
Experience in operating biological treating facilities of Angarsk Petrochemical Combine, 3:21010
Experience in local treatment of wastewaters from petrochemical production, 3:21013
Treatability studies of condensate water from Synthane coal gasification, 3:20904 (PERC/RI-77/13)
Treatment of waste streams from catalyst manufacturing plants in refineries, 3:21015
Use of technical oxygen for biochemical treatment of refinery wastewaters, 3:21009
**WATER**
*See also DRINKING WATER*
*FEEDWATER*
*GROUND WATER*
*SEAWATER*
*SURFACE WATERS*
**WATER/ACTIVATION ANALYSIS**
Instrumental neutron activation analyses for the NURE hydrogeochemical reconnaissance survey, 3:21920
**WATER/ADSORPTION**
Glycol dehydrator design manual, 3:21077 (CONF-7603113-)
**WATER/CHEMICAL ANALYSIS**
Concentration and quantitative determination of trace volatile fatty acids in water by liquid chromatography with thermal detector, 3:21931 (BNWL-tr-279)
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76, 3:22212 (PB-269652)
**WATER/CONTAMINATION**
Measurements of $^{222}Rn$ in water and indoor airborne $^{222}Rn$ originating in water, 3:22221 (HASL-325)
**WATER/INTERMOLECULAR FORCES**
Chemical applications of molecular quantum theory, 3:21947 (LBL-6699)
Revised central force potentials for water, 3:22316
**WATER/MONITORING**
Gas quality monitoring, 3:21070 (CONF-7603113-)
**WATER/NUCLEAR REACTION ANALYSIS**
Uranium analysis of natural waters by fission tracks, 3:21926
**WATER/PHOTOELECTROLYSIS**
Photoelectrolysis of water by solar radiation (Patent), 3:21315
Solar energy conversion (Patent), 3:21314
**WATER/PHOTOIONIZATION**
Photodissociative ionization in the 21 to 41 eV region: $O_2$, $N_2$, CO, NO, $CO_2$, $H_2O$, $NH_3$, and $CH_4$, 3:21991
**WATER/PHOTOLYSIS**
Evaluation of the photochemical production of hydrogen from solar energy, 3:21313 (UCID-17535)
**WATER/SAMPLING**
Methods used by HASL for ambient radon studies, 3:22166 (HASL-325)
**WATER/THERMODYNAMIC PROPERTIES**
Equation of state of water and steam for computer aided calculation of processes and equipment of power plants, 3:21500
**WATER/VIBRATIONAL STATES**
Studies of the hydrogen bonded structures of water and methanol, 3:21948 (ORO-1797-76)
**WATER CURRENTS/DATA COMPILATION**
OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available, 3:21327 (SAN-235P13-39(Vol.1))
**WATER HEATERS/WASTE HEAT UTILIZATION**
Heat recovery from domestic waste water, 3:21792
Installation permitting the recuperation of heat from waste water and the saving of water (Patent), 3:21780
**WATER POLLUTION/BIOLOGICAL EFFECTS**
Environmental significance of fin erosion in Southern California demersal fishes (Microstomus pacificus), 3:22219
**WATER POLLUTION/MONITORING**
Determination of antimony, arsenic, beryllium, cadmium, lead, selenium, silver and tellurium in environmental water samples by flameless atomic absorption. Final report, 3:22213 (PB-269902)
Trace analysis of arsenic by colorimetry, atomic absorption, and polarography. Technical report FY 76, 3:22212 (PB-269652)
**WATER POLLUTION/TRACER TECHNIQUES**
Hydrospheric trace elements and their application in tracing water pollutants, 3:22217
**WATER POLLUTION ABATEMENT/EVALUATION**
Environmental protection issues facing the nation (Appraisal by GAO), 3:21688 (PB-269748)
**WATER RESERVOIRS/WELL LOGGING**
Geophysical well logging for geohydrological purposes in unconsolidated formations, 3:22282 (N-77-26598)
**WATER RESOURCES/AVAILABILITY**
Long-term availability of water resources for energy development in the central United States, 3:21740 (CONF-7710101-5)
**WATER RESOURCES/DEMAND FACTORS**
Long-term availability of water resources for energy development in the central United States, 3:21740 (CONF-7710101-5)
**WATER RESOURCES/EVALUATION**
Planning status report: water resource appraisals for hydroelectric licensing, 3:21263 (TID-28068)
**WATER RESOURCES/OPTIMIZATION**
Defining upper limits to groundwater development in the arid West, 3:21694
**WATER RESOURCES/THERMAL POLLUTION**
Effect of heated water discharge on oxygen content in the water supply source of thermal power plants, 3:21523

**WATER WAVES/DATA COMPILATION**
OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available, 3:21327 (SAN-235P13-39(Vol.1))
**WATERFLOODING/DEMONSTRATION PROGRAMS**
Improved secondary oil recovery by controlled water flooding-pilot demonstration Ranger Zone, Fault Block VII, Wilmington Field. Phase I. Quarterly report, July-September 1977, 3:20959 (SAN/1396-12)
North Stanley Polymer Demonstration Project. First annual report, 3:20951 (COO/0029-1)
**WAVE FORCES/DATA COMPILATION**
OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available, 3:21327 (SAN-235P13-39(Vol.1))
**WAVES (SHOCK)**
*See SHOCK WAVES*
**WELDED JOINTS/CORROSION**
Factors affecting the corrosion of fusion-welded joints in coal gasification systems, 3:20872
**WELDED JOINTS/MEETINGS**
Fabrication and reliability of welded process plant. Volume I. Papers, 3:21513
**WELDING**
*(All endothermic processes for material joining.)*
*See also ARC WELDING*
*ELECTROSLAG WELDING*
**WELDING/MEETINGS**
Fabrication and reliability of welded process plant. Volume I. Papers, 3:21513
**WELDS**
*See WELDED JOINTS*
**WELL CASINGS/STANDARDS**
Casings for geothermal wells, 3:21443
**WELL DRILLING**
*See also DRILLS*
*ROTARY DRILLING*
Shape of the bottom of a drill pipe string in a borehole, 3:20971
**WELL DRILLING/COST**
U.S. oil and natural gas finding costs. Volume I, 3:20937 (FEA/G-77/356)
U.S. oil and natural gas finding costs. Volume II. Statistical appendix, 3:20938 (FEA/G-77/357)
**WELL DRILLING/REVIEWS**
Petrological approach to development of geothermal energy, 3:21441
**WELL DRILLING/ROCK MECHANICS**
Dynamic models used in planning operating parameters, 3:20964
**WELL DRILLING/SHOCK ABSORBERS**
Some results of investigation of the functioning of antivibration devices, 3:20963
**WELL DRILLING/SOLID WASTES**
Laundering of oil base mud cuttings (Patent), 3:21006
**WELL DRILLING/TESTING**
Electrodril System Field Test Program, interim phase. Final report, January-April 1977, 3:20950 (BERC/TPR-77/11)
**WEST VIRGINIA/OIL FIELDS**
Oil recovery by carbon dioxide injection. Annual report, July 1976-July 1977, 3:20954 (ORO-5301-18)
Tertiary oil recovery by $CO_2$ injection, 3:20955 (ORO-5302-16)
Tertiary oil recovery by $CO_2$ injection. Quarterly report, April-June 1977, 3:20956 (ORO-5303-15)
**WHISTLERS/COUPLING**
Modulation of randomly phased whistler wave packets by kinetic Alfven and ion quasi-modes in a magnetized plasma, 3:22521
**WHISTLERS/INSTABILITY GROWTH RATES**
Obliquely propagating whistler mode waves in cold plasmas permeated by dilute low-$\beta$ anisotropic plasmas, 3:22519
**WHITE RIVER BASIN/WATER RESOURCES**
Planning status report: water resource appraisals for hydroelectric licensing, 3:21263 (TID-28068)
**WIND/DAILY VARIATIONS**
Variance analysis of wind characteristics for energy conversion, 3:21461
**WIND/DATA COMPILATION**
OPSES-DEWAC: operational sea state and design wave criteria for Ocean Thermal Energy Conversion projects. Volume 1. Literature available, 3:21327 (SAN-235P13-39(Vol.1))
**WIND/DIRECT ENERGY CONVERSION**
Variance analysis of wind characteristics for energy conversion, 3:21461
**WIND/MATHEMATICAL MODELS**
Growth-stage scaling model for the wind-driven sea, 3:22289
**WIND POWER/AVAILABILITY**
Accuracy of wind power estimates, 3:21460 (PNL-2442)
Effect of generalized wind characteristics on annual power estimates from wind turbine generators, 3:21459 (PNL-2436)
**WIND POWER/MONITORING**
Accuracy of wind power estimates, 3:21460 (PNL-2442)
Effect of generalized wind characteristics on annual power estimates from wind turbine generators, 3:21459 (PNL-2436)
**WIND POWER PLANTS**
Development of a total energy system for the Cedar Gap Christian Retreat Center (Combination of hydroelectric units on streams, wind generators, and solar thermal power plant with wood-burning boiler backup), 3:21707
**WIND POWER PLANTS/ENERGY STORAGE**
Simulation algorithms and their realization by digital computer for calculation of wind- and solar-plant storage-service capacity, 3:21670
**WIND TURBINES/COST**
Relative cost-performance of various solar-based power supply packages, 3:21298
**WIND TURBINES/ENERGY EFFICIENCY**
Effect of aerofoil characteristics on windmill performance, 3:21462
**WIND TURBINES/PERFORMANCE**
Effect of generalized wind characteristics on annual power estimates from wind turbine generators, 3:21459 (PNL-2436)
Relative cost-performance of various solar-based power supply packages, 3:21298
**WIND TURBINES/TURBINE BLADES**
Effect of aerofoil characteristics on windmill performance, 3:21462
**WINDOWS/HEAT LOSSES**
Lowering heat consumption by means of infrared mirror coating of windows, facades and roofs, 3:21786
**WINDOWS/HEAT TRANSFER**
Heat emission of windows, exposed to the Sun, 3:21334
**WINDOWS/THERMAL INSULATION**
Insulating spacer for double insulated glass (Patent), 3:21775
**WINSTON COLLECTORS**
*See COMPOUND PARABOLIC CONCENTRATORS*
**WOOD/BIOCONVERSION**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**WOOD/COMBUSTION**
Combustion of Alternative Fuel Study (CAFS) (Recommendations for ERDA's role in waste-based fuel combustion hardware research, development, and demonstration), 3:21258 (SAN-1261/1)
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**WOOD/GASIFICATION**
Economic pre-feasibility study: large-scale methanol fuel production from surplus Canadian forest biomass. Part 2. Working papers, 3:21310 (NP-22159/2)
**WOOD/HARVESTING**
Economic pre-feasibility study: large-scale methanol fuel production from surplus Canadian forest biomass. Part 2. Working papers, 3:21310 (NP-22159/2)
**WOOD/THERMOCHEMICAL PROCESSES**
Silvicultural biomass farms. Volume V. Conversion processes and costs, 3:21309 (MTR-7347(Vol.5))
**WOOD BURNING FURNACES**
Development of a total energy system for the Cedar Gap Christian Retreat Center (Combination of hydroelectric units on streams, wind generators, and solar thermal power plant with wood-burning boiler backup), 3:21707
**WOOD WASTES/COMBUSTION**
Forest industry energy program: direct conversion, 3:21305 (CONF-770235-)
Waste burner overfire draft system (Patent), 3:21842
**WOOD WASTES/THERMOCHEMICAL PROCESSES**
Forest industry energy program: direct conversion, 3:21305 (CONF-770235-)
Preliminary experimental plan bench scale research in support of Albany Development Facility, 3:21307 (CONF-770235-)
**WORKERS**
*See PERSONNEL*
**WYOMING/BOOM TOWNS**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))
**WYOMING/COMMUNITIES**
Comprehensive community planning for energy management and conservation: developing and applying a coordinated approach to energy-related community development. Volume II, 3:21680 (HCP/M3879-1(Vol.2))

## X

**2X DEVICES/MAGNETIC FIELD REVERSAL**
Computer simulation of field reversal in mirror machines, 3:22598
**X RADIATION/GENETIC RADIATION EFFECTS**
Improved mutagen-testing systems in mice. Progress report, 1 June 1976-31 August 1977, 3:22238 (COO-3267-15)
**XENON/X-RAY FLUORESCENCE ANALYSIS**
Polarized radiation for XRF of elements with Z=47-57, 3:21939
**XENON IONS/ELECTRONIC STRUCTURE**
Electronic states of $Ar^{+}_{2}$, $Kr^{+}_{2}$, $Xe^{+}_{2}$. I. Potential curves with and without spin-orbit coupling, 3:22308
**X-RAY DETECTION/SOLID SCINTILLATION DETECTORS**
Background effects in scintillation counter telescopes in the upper atmosphere, 3:22125
**X-RAY DETECTION/TELESCOPE COUNTERS**
Background effects in scintillation counter telescopes in the upper atmosphere, 3:22125
**X-RAY FLUORESCENCE ANALYSIS/EQUIPMENT**
Recent developments in instrumentation for wavelength-dispersive x-ray analysis, 3:21938
**X-RAY FLUORESCENCE ANALYSIS/POLARIZED BEAMS**
General Chemistry Division quarterly report, July-September 1977, 3:21918 (UCID-15644-77-3)
**X-RAY RADIOGRAPHY/EQUIPMENT**
Portable low-dose x-ray imaging system, 3:22131
**X-RAY RADIOGRAPHY/RECOMMENDATIONS**
Some practical considerations in x-radiography, 3:21101 (MERC/SP-77/7)
**X-RAY SOURCES**
*See also COSMIC X-RAY SOURCES*
**X-RAY SOURCES/RADIATION PROTECTION**
Radiation protection design guidelines for 0.1 to 100 MeV particle accelerator facilities, 3:22097 (NCRP-51)
**X-RAY SPECTRA/SPECTRA UNFOLDING**
Deconvolution and background subtraction by least-squares fitting with prefiltering of spectra, 3:21943
**X-RAY SPECTROMETERS/DESIGN**
Crystal spectograph for imaging high-density targets, 3:22648 (UCRL-79787)
**X-RAY SPECTROMETERS/PERFORMANCE**
Sub-keV, subnanosecond measurements of x-ray spectra from laser-produced plasmas, 3:22425 (UCRL-79782)
**X-RAY SPECTROMETERS/PERFORMANCE TESTING**
Measuring low concentrations of plutonium and americium in earth samples, 3:22202
**XYLENES/SEPARATION PROCESSES**
Investigation of the effect of pressure on the composition of binary azeotropes, aromatic hydrocarbon $C_8$-isobutyl alcohol, 3:20999
**XYLENOLS/PYROLYSIS**
Study of the pyrolysis of toluene and phenols at low pressure, 3:20896

## Y

**YTTERBIUM/SELF-DIFFUSION**
Anomalous self-diffusion in rare earths and actinides, 3:21892
**YTTERBIUM 162/HIGH SPIN STATES**
Experimental study of Yb nuclei at high angular momentum, 3:22369
**YTTERBIUM COMPLEXES/CHEMICAL PREPARATION**
Synthetic, structural, and magnetic properties of the pyrazine-bridged lanthanide organometallic complex μ-pyrazine-bis[tris(cyclopentadienide)ytterbium (III)], $(C_5H_5)_3Yb(NC_4H_4N)Yb(C_5H_5)_3$, 3:21955
**YTTERBIUM COMPLEXES/CRYSTAL STRUCTURE**
Synthetic, structural, and magnetic properties of the pyrazine-bridged lanthanide organometallic complex μ-pyrazine-bis[tris(cyclopentadienide)ytterbium (III)], $(C_5H_5)_3Yb(NC_4H_4N)Yb(C_5H_5)_3$, 3:21955
**YTTERBIUM COMPLEXES/MAGNETIC PROPERTIES**
Synthetic, structural, and magnetic properties of the pyrazine-bridged lanthanide organometallic complex μ-pyrazine-bis[tris(cyclopentadienide)ytterbium (III)], $(C_5H_5)_3Yb(NC_4H_4N)Yb(C_5H_5)_3$, 3:21955
**YTTERBIUM COMPLEXES/NUCLEAR MAGNETIC RESONANCE**
Nuclear magnetic resonance study of the structure in solution of lanthanide complexes with benzene-1,2-dioxydiacetate, 3:21960
**YTTERBIUM COMPOUNDS/MOESSBAUER EFFECT**
Paramagnetic spin relaxation in $Cs_2NaYbCl_6$, 3:21969
**YUGOSLAVIA/NATURAL GAS INDUSTRY**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004
**YUGOSLAVIA/PETROLEUM INDUSTRY**
Brief review of activities of the Yugoslav petroleum industry in 1976, 3:21004

## Z

**ZERO POWER REACTORS/REACTOR KINETICS**
Measurement of anisotropy of diffusion coefficient in plate cell, 3:21626
**ZERO POWER REACTORS/THERMONUCLEAR FUELS**
Cost of tritium bred in a critical fission reactor, 3:22628
**ZINC/ACTIVATION ANALYSIS**
Applications of neutron activation analysis for the determination of cobalt, zinc, silver, and arsenic distributions in the Atlantic Ocean, 3:21925
**ZINC/CHEMICAL VAPOR DEPOSITION**
Improving the wear-resistance characteristics of metal surfaces through vacuum production techniques, 3:21876 (BNWL-tr-277)
**ZINC/MAGNETIC SUSCEPTIBILITY**
Magnetic properties of zinc and of cadmium alloys with magnesium and with mercury, 3:21890
**ZINC CHLORIDES/RECOVERY**
Recovery of zinc chloride catalyst from coal hydrogenation char, 3:20882
**ZINC COMPLEXES/CHEMICAL REACTION KINETICS**
Equilibrium constants for the metalation of zinc porphyrins, 3:21963
**ZINC HALIDE PROCESS/CATALYSTS**
Recovery of zinc chloride catalyst from coal hydrogenation char, 3:20882
**ZINC OXIDES/CATALYTIC EFFECTS**
Study of thermochemical hydrogen preparation. III. An oxygen-evolving step through the thermal splitting of sulfuric acid, 3:21250
**ZIRCALOY 2/PHYSICAL RADIATION EFFECTS**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report (BWR, PWR), 3:21556 (EPRI-NP-567)
**ZIRCALOY 2/STRESS CORROSION**
Stress corrosion cracking of Zircaloy-2 cladding in iodine vapor, 3:21616
**ZIRCALOY 2/TENSILE PROPERTIES**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report (BWR, PWR), 3:21556 (EPRI-NP-567)
**ZIRCALOY 4/PHYSICAL RADIATION EFFECTS**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report (BWR, PWR), 3:21556 (EPRI-NP-567)
Influence of specifically nuclear phenomena on the selection of metallic materials, 3:21610
**ZIRCALOY 4/TENSILE PROPERTIES**
Development of the materials code, MATMOD (constitutive equations for Zircaloy). Final report (BWR, PWR), 3:21556 (EPRI-NP-567)
**ZIRCONIUM/X-RAY FLUORESCENCE ANALYSIS**
Automated preparation and XRF analysis of major/minor elemental concentrations in geological samples, 3:21936
**ZIRCONIUM 90 TARGET/NEUTRON REACTIONS**
Neutron resonance parameters of $^{90}Zr$ below 300 keV, 3:22365
**ZIRCONIUM 91 TARGET/NEUTRON REACTIONS**
High resolution neutron transmission and capture for $^{91}Zr$, 3:22366
**ZIRCONIUM 95/ENVIRONMENTAL TRANSPORT**
Radionuclides and lead in surface air, 3:22159 (EML-334(App.))
Updating stratospheric inventories to April 1977 (Fallout radionuclides), 3:22153 (EML-334)
**ZIRCONIUM 95/RADIOMETRIC ANALYSIS**
EML Surface Air Sampling Program: the quality of analysis, 1976 (Fallout radionuclides and stable Pb), 3:22154 (EML-334)
**ZIRCONIUM ALLOYS/CRITICAL CURRENT**
Vortex-pinning forces in superconducting niobium-zirconium alloys with low j/sub c/, 3:21889
**ZIRCONIUM ALLOYS/IRRADIATION PROCEDURES**
DT fusion neutron irradiation of LLL Nb-1Zr tensile specimens at 600°C, 3:21895 (UCID-17666)
**ZIRCONIUM ALLOYS/MAGNETIC FLUX**
Vortex-pinning forces in superconducting niobium-zirconium alloys with low j/sub c/, 3:21889
**ZIRCONIUM ALLOYS/PHYSICAL RADIATION EFFECTS**
DT fusion neutron irradiation of LLL Nb-1Zr tensile specimens at 600°C, 3:21895 (UCID-17666)

ZIRCONIUM ALLOYS/SPECIFIC HEAT
Low temperature heat capacity of scandium and alloys of scandium, 3:21882 (IS-T-780)
ZIRCONIUM ALLOYS/SUPERCONDUCTIVITY
Peak effect in type II superconductors, 3:21875
ZIRCONIUM CARBIDES/THERMIONIC EMISSION
Thermionic emission of zirconium carbide in hydrogen, 3:21905
ZIRCONIUM OXIDES/REFRACTIVITY
Refractive index and surface layers of ceramic $(Pb,La)(Zr,Ti)O_3$ compounds, 3:21904

# CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which reports announced in this publication were prepared are included in this index.


| *Contract No.* | *Abstract No.* | *Report No.* |
|---|---|---|
| **EA-77-A-01-6010** | **National Bureau of Standards, Washington, D.C. (USA). Inst. for Basic Standards** | |
| | 3:21550 | HCP/T6010—E1 |
| **EA-77-A-01-6010-051** | **National Bureau of Standards, Washington, D.C. (USA). Inst. for Applied Technology** | |
| | 3:21331 | NBSIR—77-1314 |
| **EC-77-S-02-4490** | **Lehigh Univ., Bethlehem, Pa. (USA)** | |
| | 3:21772 | COO/4490—1 |
| **EF-76-C-05-5301** | **Pennzoil Co., Vienna, W.Va. (USA)** | |
| | 3:20954 | ORO—5301-18 |
| **EF-76-C-05-5302** | **Columbia Gas Transmission Corp., Charleston, W.Va. (USA)** | |
| | 3:20955 | ORO—5302-16 |
| | 3:20956 | ORO—5303-15 |
| **EF-77-A-01-2616** | **Jet Propulsion Lab., Pasadena, Calif. (USA)** | |
| | 3:20852 | DOE/JPL/2616—2 |
| **EF-77-A-04-3880** | **Equity Oil Co., Salt Lake City, Utah (USA)** | |
| | 3:21104 | TID—27970 |
| **EF-77-C-01-2579** | **Combustion Power Co., Inc., Menlo Park, Calif. (USA)** | |
| | 3:20902 | FE—2579-10 |
| **EF-77-C-01-2615** | **Mechanical Technology, Inc., Latham, N.Y. (USA)** | |
| | 3:21103 | MTI—78TR16 |
| **EF-77-C-01-2660** | **Hudson Inst., Inc., Croton-on-Hudson, N.Y. (USA)** | |
| | 3:21723 | FE/2660—1 |
| **EF-77-C-03-1396** | **City of Long Beach, Calif. (USA)** | |
| | 3:20959 | SAN/1396—12 |
| **EF-77-S-01-2692** | **West Virginia Univ., Morgantown (USA). Coal Research Bureau** | |
| | 3:20892 | FE/2692—1 |
| **EF-77-S-02-4246** | **Notre Dame Univ., Ind. (USA). Coll. of Engineering** | |
| | 3:21878 | COO—4246-2 |
| **EG-77-C-03-1317** | **TRW Systems and Energy, Redondo Beach, Calif. (USA)** | |
| | 3:21450 | SAN/1317—3 |
| **EG-77-C-04-3987** | **Energy Research and Development Administration, Albuquerque, N.Mex. (USA). Albuquerque Operations Office** | |
| | 3:21323 | ALO/3987—1/2 |
| | 3:21324 | ALO/3987—1/3 |
| **EG-77-S-05-5594** | **Texas Univ., Austin (USA)** | |
| | 3:22604 | ORO—5594-9 |
| **EN-77-C-02-4188** | **Donovan, Hamester and Rattien, Inc., Washington, D.C. (USA)** | |
| | 3:21472 | COO/4188—2 |
| **EN-77-S-02-4295** | **Pittsburgh Univ., Pa. (USA)** | |
| | 3:21141 | COO/4295—1 |
| **ES-77-S-02-4251** | **Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.** | |
| | 3:22019 | COO—4251-4 |
| | 3:22637 | COO—4251-5 |
| **EX-76-A-31-1011** | **National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center** | |
| | 3:21856 | CONS/1011—21 |
| **EX-76-C-01-1221** | **Institute of Gas Technology, Chicago, Ill. (USA)** | |
| | 3:20850 | CONF-780305—1 |
| | 3:20875 | CONF-770814—10 |
| **EX-76-C-01-1231** | **Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering** | |
| | 3:20916 | FE—1231-9 |
| **EX-76-C-01-1234** | **Parsons (Ralph M.) Co., Pasadena, Calif. (USA)** | |
| | 3:20877 | FE—1234-8 |
| **EX-76-C-01-1511** | **National Research Development Corp., London (UK)** | |
| | 3:20927 | FE—1511-39 |
| **EX-76-C-01-1770** | **Systems, Science and Software, La Jolla, Calif. (USA)** | |
| | 3:20854 | FE—1770-26 |
| **EX-76-C-01-2011** | **Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering** | |
| | 3:20878 | FE—2011-9 |
| **EX-76-C-01-2015** | **Avco-Everett Research Lab., Inc., Everett, Mass. (USA)** | |
| | 3:20855 | FE—2015-20 |
| | 3:21752 | FE—2015-12 |
| | 3:21753 | FE—2015-21 |
| **EX-76-C-01-2030** | **Pennsylvania State Univ., University Park (USA). Coal Research Section** | |
| | 3:20889 | FE—2030-8 |
| **EX-76-C-01-2081** | **Mitre Corp., McLean, Va. (USA). METREK Div.** | |
| | 3:21309 | MTR—7347(Vol.5) |
| **EX-76-C-01-2205** | **New Hampshire Univ., Durham (USA). Dept. of Chemical Engineering** | |
| | 3:20890 | FE—2205-7 |
| | 3:20901 | FE—2205-8 |
| **EX-76-C-01-2215** | **Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.** | |
| | 3:21754 | FE—2215-7 |
| **EX-76-C-01-2243** | **STD Research Corp., Arcadia, Calif. (USA)** | |
| | 3:21764 | FE—2243-9 |
| **EX-76-C-01-2276** | **Mobil Research and Development Corp., Paulsboro, N.J. (USA)** | |
| | 3:21257 | FE—2276-6 |
| **EX-76-C-01-2288** | **Midwest Research Inst., Kansas City, Mo. (USA)** | |
| | 3:20928 | FE—2288-16 |
| **EX-76-C-01-2292** | **United Technologies Corp., Farmington, Conn. (USA). Power Systems Div.** | |
| | 3:21485 | FE—2292-9 |
| **EX-76-C-01-2295** | **Massachusetts Inst. of Tech., Cambridge (USA). National Magnet Lab.** | |
| | 3:21759 | FE—2295-1 |
| **EX-76-C-01-2295-009** | **Massachusetts Inst. of Tech., Cambridge (USA)** | |
| | 3:20859 | MIT—2295T9-1 |
| | 3:20860 | MIT—2295T9-2 |
| **EX-76-C-01-2341** | **Stanford Univ., Calif. (USA)** | |
| | 3:21765 | FE—2341-2 |
| **EX-76-C-01-2343** | **Booz, Allen and Hamilton, Inc., Bethesda, Md. (USA). Booz, Allen Applied Research Div.** | |
| | 3:21726 | FE—2343-45 |

| *Contract No.* | *Abstract No.* | *Report No.* |
|---|---|---|
| **EX-76-C-01-2355** | **Consolidated Controls Corp., El Segundo, Calif. (USA)** | |
| | 3:20856 | FE—2355-2(Rev.D) |
| **EX-76-C-01-2357** | **General Electric Co., Schenectady, N.Y. (USA)** | |
| | 3:21482 | TID—27939 |
| **EX-76-C-01-2426** | **Institute of Gas Technology, Chicago, Ill. (USA)** | |
| | 3:21326 | DSE/2426—19 |
| **EX-76-C-01-2435** | **Institute of Gas Technology, Chicago, Ill. (USA)** | |
| | 3:21253 | FE—2435-19 |
| **EX-76-C-01-2467** | **Texas A and M Univ., College Station (USA). Dept. of Chemistry** | |
| | 3:20858 | FE—2467-4 |
| **EX-76-C-01-2479** | **Virginia Univ., Charlottesville (USA). Research Labs. for the Engineering Sciences** | |
| | 3:20840 | FE—2479-1 |
| **EX-76-C-01-2515** | **Pullman Kellogg, Houston, Tex. (USA)** | |
| | 3:20953 | FE—2515-10 |
| **EX-76-C-01-2556** | **Massachusetts Inst. of Tech., Cambridge (USA). High Voltage Research Lab.** | |
| | 3:21549 | EPRI-EL—220 |
| **EX-76-C-10-3879** | **Resource Planning Associates, Inc., Washington, D.C. (USA)** | |
| | 3:21680 | HCP/M3879—1(Vol.2) |
| | 3:21681 | HCP/M3879—1(Vol.1) |
| | 3:21682 | HCP/M3879—0003 |
| **EX-76-C-23-1010** | **Boston Univ., Mass. (USA). Dept. of Chemistry** | |
| | 3:21312 | CONF-760889— |
| **EX-76-S-01-2414** | **Wyoming Univ., Laramie (USA). Dept. of Electrical Engineering** | |
| | 3:20857 | FE—2414-4 |
| **EX-76-X-10-5377** | **Council for Educational Development and Research, Washington, D.C. (USA)** | |
| | 3:21678 | CONF-7706101— |
| **EX-77-G-01-6006** | **Council for Educational Development and Research, Washington, D.C. (USA)** | |
| | 3:21678 | CONF-7706101— |
| **EY-76-C-01-1518** | **Institute of Gas Technology, Chicago, Ill. (USA)** | |
| | 3:21252 | FE—1518-46 |
| **EY-76-C-02-0016** | **Brookhaven National Lab., Upton, N.Y. (USA)** | |
| | 3:21677 | BNL—50501-R |
| | 3:21679 | BNL—22677 |
| | 3:22120 | BNL—23493 |
| | 3:22613 | BNL—23389 |
| | 3:22614 | BNL—23391 |
| **EY-76-C-02-0029** | **Kewanee Oil Co., Tulsa, Okla. (USA)** | |
| | 3:20951 | COO/0029—1 |
| **EY-76-C-02-0038** | **Notre Dame Univ., Ind. (USA). Radiation Lab.** | |
| | 3:22264 | COO—38-1838 |
| **EY-76-C-02-1545** | **Ohio State Univ. Research Foundation, Columbus (USA)** | |
| | 3:22326 | COO—1545-222 |
| **EY-76-C-02-2331** | **Minnesota Mining and Mfg. Co., St. Paul (USA). Technical Ceramic Products Div.** | |
| | 3:21915 | MMM—2473-0422 |
| **EY-76-C-02-2477** | **United Engineers and Constructors, Inc., Philadelphia, Pa. (USA)** | |
| | 3:21596 | COO—2477-13(Vol.1) |
| **EY-76-C-02-2608** | **Corning Glass Works, N.Y. (USA)** | |
| | 3:21367 | COO/2608—1 |
| **EY-76-C-02-2627** | **AAI Corp., Baltimore, Md. (USA)** | |
| | 3:21329 | COO/2627—2 |
| **EY-76-C-02-2631** | **Ford Motor Co., Dearborn, Mich. (USA)** | |
| | 3:21855 | COO—2631-22 |
| **EY-76-C-02-3000** | **Argonne National Lab., Ill. (USA)** | |
| | 3:22341 | FERMILAB-Conf—77/66-THY |
| | 3:22350 | FERMILAB-Conf—77/65-THY |
| **EY-76-C-02-3073** | **Princeton Univ., N.J. (USA). Plasma Physics Lab.** | |
| | 3:22420 | PPPL—1394 |
| | 3:22449 | PPPL—1403 |
| | 3:22456 | PPPL—1401 |
| | 3:22457 | PPPL—1404 |
| | 3:22477 | PPPL—1397 |
| | 3:22478 | PPPL—1400 |
| | 3:22607 | CONF-771029—153 |
| | 3:22683 | PPPL—1399 |
| **EY-76-C-02-3425** | **Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Garmisch-Partenkirchen (Germany, F.R.). Inst. fuer Atmosphaerische Umweltforschung** | |
| | 3:22191 | NYO—3425-14 |
| **EY-76-C-02-4030** | **Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Research and Development Center** | |
| | 3:22018 | COO—4030-4 |
| **EY-76-C-02-4098** | **Terra Tek, Inc., Salt Lake City, Utah (USA)** | |
| | 3:20952 | COO/4098—1 |
| **EY-76-C-03-0115-108** | **Stanford Research Inst., Menlo Park, Calif. (USA)** | |
| | 3:21427 | SAN—115P108-1(Vol.2) |
| | 3:21428 | SAN—115P108-1(Vol.1) |
| **EY-76-C-03-0167** | **General Atomic Co., San Diego, Calif. (USA)** | |
| | 3:21573 | GA-A—14684 |
| **EY-76-C-03-0167-017** | **General Atomic Co., San Diego, Calif. (USA)** | |
| | 3:21571 | GA-A—13557 |
| | 3:21572 | GA-A—13723 |
| **EY-76-C-03-0167-023** | **General Atomic Co., San Diego, Calif. (USA)** | |
| | 3:21583 | GA-A—14121 |
| | 3:21584 | GA-A—14613 |
| **EY-76-C-03-0167-053** | **General Atomic Co., San Diego, Calif. (USA)** | |
| | 3:21151 | GA-A—14678 |
| **EY-76-C-03-0824-014** | **Atomics International Div., Canoga Park, Calif. (USA)** | |
| | 3:21588 | TID—27816 |
| **EY-76-C-03-0893-001** | **Borg-Warner Corp., Los Angeles, Calif. (USA). Byron Jackson Pump Div.** | |
| | 3:21589 | TID—27895 |
| **EY-76-C-03-1108** | **McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)** | |
| | 3:21318 | SAN/1108—8/2 |
| | 3:21319 | SAN/1108—8/3 |
| | 3:21320 | SAN/1108—8/4 |
| | 3:21321 | SAN/1108—8/5 |
| **EY-76-C-03-1132** | **McDonnell Douglas Astronautics Co., Huntington Beach, Calif. (USA)** | |
| | 3:21325 | SAN/1132—2/4 |
| **EY-76-C-03-1141** | **Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.** | |
| | 3:21590 | WARD—353 |
| **EY-76-C-03-1148** | **Kaman Sciences Corp., Colorado Springs, Colo. (USA)** | |
| | 3:21659 | K—76-124U(R)(Vol.2) |
| **EY-76-C-03-1164** | **LMC Corp., Sparks, Nev. (USA)** | |
| | 3:21858 | SAN/1164—1 |
| **EY-76-C-03-1220** | **General Electric Co., Philadelphia, Pa. (USA). Space Div.** | |
| | 3:21360 | SAN/1220—1 |
| **EY-76-C-03-1261** | **TRW Systems Group, McLean, Va. (USA)** | |
| | 3:21258 | SAN—1261/1 |
| **EY-76-C-04-0053** | **Mound Lab., Miamisburg, Ohio (USA)** | |
| | 3:20935 | MLM—2497(OP) |
| | 3:22012 | MLM—2447 |
| **EY-76-C-04-0487** | **Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)** | |
| | 3:22133 | MHSMP—77-57 |
| | 3:22134 | MHSMP—77-58 |
| **EY-76-C-04-0613** | **Bendix Corp., Kansas City, Mo. (USA)** | |
| | 3:21873 | BDX—613-1634(Rev.) |
| | 3:21910 | BDX—613-1691(Rev.) |
| | 3:22077 | BDX—613-1875 |
| | 3:22138 | BDX—613-1945 |
| **EY-76-C-04-0789** | **Sandia Labs., Albuquerque, N.Mex. (USA)** | |
| | 3:20862 | SAND—77-1821 |
| | 3:21167 | SAND—77-7024 |
| | 3:21240 | SAND—77-1411 |
| | 3:21268 | SAND—77-0874 |
| | 3:21271 | SAND—77-1412C |
| | 3:21384 | SAND—77-8264 |
| | 3:21625 | SAND—77-1116C |
| | 3:21644 | SAND—76-0614 |
| | 3:21859 | SAND—78-0030C |
| | 3:21977 | MHSMP—77-60 |
| | 3:22001 | SAND—77-0646 |
| | 3:22002 | SAND—77-1436C |
| | 3:22079 | SAND—77-1599 |
| | 3:22129 | SAND—77-1914C |
| | 3:22140 | SAND—77-8040 |
| | 3:22260 | ORNL-tr—4547 |
| | 3:22385 | SAND—77-1148 |
| | 3:22421 | SAND—77-1829C |
| | 3:22640 | SAND—77-1495C |
| | 3:22641 | SAND—77-1592C |
| | 3:22692 | SAND—77-1023 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| **EY-76-C-04-0893** | **Sandia Labs., Albuquerque, N.Mex. (USA)** | |
| | 3:21221 | SAND—77-0043 |
| **EY-76-C-04-3533** | **Atomics International Div., Golden, Colo. (USA). Rocky Flats Plant** | |
| | 3:21166 | RFP—2458 |
| | 3:21172 | MLM—2463 |
| | 3:22010 | RFP—2433 |
| | 3:22281 | RFP—2434 |
| **EY-76-C-05-2504** | **Maryland Univ., College Park (USA). Dept. of Physics and Astronomy** | |
| | 3:22119 | ORO—2504-267 |
| **EY-76-C-05-3688** | **National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.** | |
| | 3:22149 | TID—27836 |
| **EY-76-C-05-4339** | **Geological Survey, Washington, D.C. (USA)** | |
| | 3:21183 | USGS-OFR—77-761 |
| **EY-76-C-05-5199** | **West Virginia Geological Survey, Morgantown (USA)** | |
| | 3:21101 | MERC/SP—77/7 |
| **EY-76-C-05-5217** | **Dow Chemical Co., Midland, Mich. (USA)** | |
| | 3:21672 | ORO/5217—1 |
| **EY-76-C-06-1830** | **Battelle Pacific Northwest Labs., Richland, Wash. (USA)** | |
| | 3:21459 | PNL—2436 |
| | 3:21460 | PNL—2442 |
| | 3:21758 | BNWL—2004-6 |
| | 3:22013 | BNWL—2260-3 |
| | 3:22141 | PNL—2433 |
| | 3:22207 | PNL—2383 |
| **EY-76-C-06-2130** | **Atlantic Richfield Hanford Co., Richland, Wash. (USA)** | |
| | 3:22223 | ARH-LD—162 |
| **EY-76-C-07-1540** | **Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs - Operations Office** | |
| | 3:21169 | ICP—1132 |
| | 3:21170 | ICP—1136 |
| **EY-76-C-07-1570** | **EG and G Idaho, Inc., Idaho Falls (USA)** | |
| | 3:21562 | LTR—1310-17 |
| | 3:21645 | TREE-NUREG—1124 |
| | 3:21646 | TREE-NUREG—1137 |
| | 3:21647 | TREE-NUREG—1151 |
| | 3:21648 | TREE-NUREG—1188 |
| | 3:22361 | TREE—1115 |
| **EY-76-C-09-0001** | **Du Pont de Nemours (E.I.) and Co., Aiken, S.C. (USA). Savannah River Lab.** | |
| | 3:21118 | DPST—77-146-2 |
| | 3:21119 | DPST—77-363 |
| | 3:21165 | DP—1468 |
| | 3:21180 | DP—1476 |
| | 3:22011 | DP-MS—77-49 |
| | 3:22679 | DP-MS—77-47 |
| **EY-76-C-13-1658** | **Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)** | |
| | 3:21201 | GJT—125 |
| | 3:22160 | GJT—18 |
| | 3:22161 | GJT—18S |
| | 3:22162 | GJT—20 |
| **EY-76-C-13-1664** | **Bendix Field Engineering Corp., Grand Junction, Colo. (USA)** | |
| | 3:21120 | GJBX—3(78) |
| | 3:21121 | GJBX—7(78) |
| | 3:21122 | GJBX—78(77) |
| | 3:21123 | GJBX—82(77) |
| | 3:21124 | GJBX—92(77) |
| **EY-76-C-14-2170** | **Hanford Engineering Development Lab., Richland, Wash. (USA)** | |
| | 3:21585 | HEDL-TME—77-37 |
| | 3:21586 | HEDL-TME—77-38 |
| | 3:22378 | HEDL-SA—1148(Rev.1) |
| | 3:22680 | HEDL-SA—1252 |
| | 3:22681 | HEDL-TME—77-81 |
| **EY-76-C-15-1200** | **Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.** | |
| | 3:21581 | CRBRP-ARD—0147 |
| | 3:21582 | CRBRP-ARD—0188 |
| | 3:21635 | CRBRP-ARD—0185(Vol.1) |
| **EY-76-C-15-2395** | **General Electric Co., Sunnyvale, Calif. (USA)** | |
| | 3:21578 | CONF-760735—1 |
| | 3:21581 | CRBRP-ARD—0147 |
| | 3:21582 | CRBRP-ARD—0188 |
| | 3:21635 | CRBRP-ARD—0185(Vol.1) |
| **EY-76-S-02-0020** | **Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry** | |
| | 3:20874 | BERC—0020-9 |
| **EY-76-S-02-0913** | **Minnesota Univ., Minneapolis (USA)** | |
| | 3:21992 | COO—913-68 |
| **EY-76-S-02-1569** | **Minnesota Univ., Minneapolis (USA)** | |
| | 3:22324 | TID—27646 |
| **EY-76-S-02-2007** | **Illinois Univ., Urbana (USA). Fusion Studies Lab.** | |
| | 3:22636 | COO—2007-92 |
| **EY-76-S-02-2185** | **Columbia Univ., Palisades, N.Y. (USA). Lamont-Doherty Geological Observatory** | |
| | 3:22215 | TID—22790 |
| **EY-76-S-02-2250** | **Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering** | |
| | 3:21580 | COO—2250-30 |
| **EY-76-S-02-2307** | **Cincinnati Univ., Ohio (USA). Dept. of Biological Sciences** | |
| | 3:22198 | COO—2307-13 |
| **EY-76-S-02-2362** | **Pennsylvania State Univ., University Park (USA). Dept. of Biochemistry and Biophysics** | |
| | 3:22252 | COO—2362-27 |
| **EY-76-S-02-2363** | **Pennsylvania Univ., Philadelphia (USA)** | |
| | 3:22268 | COO—2363-4 |
| **EY-76-S-02-2383** | **Illinois Univ., Urbana (USA). Dept. of Computer Science** | |
| | 3:22690 | COO—2383-45 |
| **EY-76-S-02-2765** | **Illinois Univ., Urbana (USA). Gaseous Electronics Lab.** | |
| | 3:22617 | COO—2765-7 |
| **EY-76-S-02-2789** | **Princeton Univ., N.J. (USA). Center for Environmental Studies** | |
| | 3:21784 | COO/2789—1 |
| **EY-76-S-02-2837** | **Kansas Univ., Lawrence (USA)** | |
| | 3:21975 | COO—2837-3 |
| **EY-76-S-02-2898** | **North Dakota State Univ., Fargo (USA). Dept. of Chemistry** | |
| | 3:20888 | COO—2898-10 |
| **EY-76-S-02-3267** | **Jackson Lab., Bar Harbor, Maine (USA)** | |
| | 3:22238 | COO—3267-15 |
| **EY-76-S-02-3498** | **Rochester Univ., N.Y. (USA). Dept. of Chemistry** | |
| | 3:21140 | COO—3498-30 |
| **EY-76-S-02-3568** | **Woods Hole Oceanographic Institution, Mass. (USA)** | |
| | 3:22220 | COO—3568-18 |
| **EY-76-S-03-0034-251** | **California Univ., Berkeley (USA). Lawrence Berkeley Lab.** | |
| | 3:21311 | TID—27702 |
| **EY-76-S-03-0235-013** | **Hawaii Univ., Honolulu (USA). James K.K. Look Lab. of Oceanographic Engineering** | |
| | 3:21327 | SAN—235P13-39(Vol.1) |
| **EY-76-S-03-0326** | **Stanford Linear Accelerator Center, Calif. (USA)** | |
| | 3:22339 | SLAC-PUB—1602 |
| | 3:22347 | SLAC-PUB—2051 |
| | 3:22380 | SLAC-PUB—1601 |
| | 3:22381 | SLAC-PUB—2010 |
| **EY-76-S-03-0326-039** | **Stanford Univ., Calif. (USA). Digital Systems Lab.** | |
| | 3:22693 | SU—326-P.39-26 |
| **EY-76-S-04-3779** | **Energy Research and Development Administration, Washington, D.C. (USA). Div. of Solar Energy** | |
| | 3:21302 | CONF-770235— |
| **EY-76-S-05-1797** | **Florida State Univ., Tallahassee (USA). Dept. of Chemistry** | |
| | 3:21948 | ORO—1797-76 |
| **EY-76-S-05-3018** | **Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry** | |
| | 3:21978 | ORO—3018-180 |
| **EY-76-S-05-4908** | **Maryland Univ., College Park (USA). CCMS Projects Office** | |
| | 3:21333 | UMD—4908-10 |
| **EY-76-S-05-5065** | **West Virginia Univ., Morgantown (USA). Dept. of Geology** | |
| | 3:20891 | FE—5065-2 |
| **EY-76-S-06-2225-005** | **Washington Univ., Seattle (USA). Dept. of Genetics** | |
| | 3:22239 | RLO/2225/T5—35 |
| **EY-76-S-06-2225-031** | **Washington Univ., Seattle (USA)** | |
| | 3:22379 | RLO/2225/T3—6 |
| **EY-76-S-06-2228-003** | **Montana State Univ., Bozeman (USA)** | |
| | 3:20914 | RLO/2228/T003—2 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| EY-76-S-06-2229-001 | Alaska Univ., Fairbanks (USA). Inst. of Marine Science | |
| | 3:22214 | RLO/2229/T1—41 |
| | 3:22286 | RLO/2229/T1—40 |
| EY-76-S-06-2232-001 | Montana Univ., Missoula (USA) | |
| | 3:22358 | RLO—2232-T1-4 |
| EY-76-S-09-0946 | Georgia Univ., Athens (USA). Dept. of Physics | |
| | 3:22348 | SRO—946-1 |
| NAS-7-100-954356 | Honeywell Corporate Material Sciences Center, Bloomington, Minn. (USA) | |
| | 3:21273 | ERDA/JPL/954356—77/3 |
| NAS-7-100-954374 | Varian Associates, Lexington, Mass. (USA). Lexington Vacuum Div. | |
| | 3:21274 | ERDA/JPL/954374—77/3 |
| NAS-7-100-954458 | Rockwell International Corp., Anaheim, Calif. (USA). Autonetics Group | |
| | 3:21275 | ERDA/JPL/954458—77/6 |
| NAS-7-100-954471 | Stanford Research Inst., Menlo Park, Calif. (USA) | |
| | 3:21276 | ERDA/JPL/954471—77/3 |
| NAS-7-100-954605 | Sensor Technology, Inc., Chatsworth, Calif. (USA) | |
| | 3:21277 | ERDA/JPL/954605—77/3 |
| NAS-7-100-954777 | Aerochem Research Labs., Inc., Princeton, N.J. (USA) | |
| | 3:21278 | ERDA/JPL/954777—77/1 |
| W-31-109-ENG-38 | Argonne National Lab., Ill. (USA) | |
| | 3:20887 | CONF-771072—3 |
| | 3:20911 | CONF-7710101—4 |
| | 3:20922 | ANL—77-14 |
| | 3:20923 | ANL/CTIU/FE—005 |
| | 3:21308 | CONF-770582—1 |
| | 3:21522 | CONF-771024—3 |
| | 3:21524 | CONF-7710101—3 |
| | 3:21579 | CONF-771023—23 |
| | 3:21739 | CONF-7710101—1 |
| | 3:21740 | CONF-7710101—5 |
| | 3:21755 | TID—27152 |
| | 3:21846 | ANL/CES/TE—77-1 |
| | 3:21847 | ANL/CES/TE—77-4 |
| | 3:21877 | CONF-761027—25 |
| | 3:21901 | CONF-771080—2 |
| | 3:22210 | ANL/ES—61 |
| | 3:22311 | CONF-770931—4 |
| | 3:22314 | CONF-770935—4 |
| | 3:22317 | CONF-761027—26 |
| | 3:22535 | CONF-771029—190 |
| | 3:22577 | CONF-771029—189 |
| | 3:22593 | CONF-771029—184 |
| | 3:22595 | CONF-771029—199 |
| | 3:22616 | CONF-771029—188 |
| | 3:22676 | CONF-771029—182 |
| | 3:22677 | CONF-771036—6 |
| W-31-109-ENG-3635 | Systems Research Labs., Inc., Dayton, Ohio (USA) | |
| | 3:21755 | TID—27152 |
| W-7405-ENG-26 | Oak Ridge National Lab., Tenn. (USA) | |
| | 3:20849 | CONF-771145—2 |
| | 3:21125 | K/UR—3(Pt.5) |
| | 3:21144 | ORNL/TM—6136 |
| | 3:21153 | ORNL/TM—6092 |
| | 3:21181 | ORNL/Sub—4415 |
| | 3:21184 | Y/OWI/SUB—77/16523/2 |
| | 3:21185 | Y/OWI/SUB—77/16535/2 |
| | 3:21186 | Y/OWI/SUB—77/16535/4 |
| | 3:21187 | Y/OWI/SUB—77/16535/7 |
| | 3:21188 | Y/OWI/SUB—77/16535/8 |
| | 3:21189 | Y/OWI/SUB—77/16537 |
| | 3:21190 | Y/OWI/SUB—4091/6 |
| | 3:21191 | Y/OWI/SUB—4310/4 |
| | 3:21208 | DOE/EV—0005-1 |
| | 3:21211 | Y/OWI/SUB—77/42509 |
| | 3:21241 | ORNL/TM—5908 |
| | 3:21531 | ORNL/EIS—122 |
| | 3:21587 | ORNL/TM—5920 |
| | 3:21643 | ORNL/NUREG/TM—124 |
| | 3:21986 | Y—2107 |
| | 3:22016 | Y/OWI/SUB—77-22324(Vol.2)(App.) |
| | 3:22139 | CONF-771055—1 |
| | 3:22228 | CONF-770961—3 |
| | 3:22386 | ORNL/TM—6108 |
| | 3:22404 | CONF-771109—85 |
| | 3:22419 | CONF-770954—5 |
| | 3:22455 | ORNL/TM—6103 |
| | 3:22476 | ORNL/TM—5967 |
| | 3:22488 | ORNL-tr—4410 |
| | 3:22534 | CONF-771029—150 |
| | 3:22536 | CONF-771109—57 |
| | 3:22537 | CONF-771109—65 |
| | 3:22544 | WFPS-TME—062 |
| | 3:22555 | ORNL-tr—4530 |
| | 3:22576 | ORNL-tr—4531 |
| | 3:22579 | ORNL/TM—6148 |
| | 3:22580 | WFPS-TME—060 |
| | 3:22591 | CONF-771029—149 |
| | 3:22592 | CONF-771029—180 |
| | 3:22594 | CONF-771029—193 |
| | 3:22597 | WFPS-TME—059 |
| | 3:22603 | ORNL/TM—6079 |
| | 3:22615 | CONF-771029—147 |
| | 3:22678 | CONF-771109—84 |
| | 3:22682 | ORNL—5302 |
| W-7405-ENG-36 | Los Alamos Scientific Lab., N.Mex. (USA) | |
| | 3:21109 | LA—7062-MS |
| | 3:21243 | CONF-770593— |
| | 3:21432 | LA—6972 |
| | 3:21448 | LA—7021-C |
| | 3:21553 | LA—7037-PR |
| | 3:22078 | LA—6985 |
| | 3:22096 | LA—7023-PR |
| | 3:22103 | LA—6919 |
| | 3:22111 | LA-tr—77-70 |
| | 3:22114 | LA—7077-T |
| | 3:22118 | LA—7034-MS |
| | 3:22253 | LA-tr—77-75 |
| | 3:22262 | LA-tr—77-67 |
| | 3:22263 | LA-tr—77-77B |
| | 3:22332 | LA-tr—77-76 |
| | 3:22338 | LA-tr—77-74 |
| | 3:22367 | LA-tr—84 |
| | 3:22447 | LA-tr—77-69 |
| | 3:22605 | WFPS-TME—064 |
| | 3:22638 | LA—7014-MS |
| W-7405-ENG-38 | Argonne National Lab., Ill. (USA) | |
| | 3:22341 | FERMILAB-Conf—77/66-THY |
| | 3:22350 | FERMILAB-Conf—77/65-THY |
| | 3:22689 | CONF-7706104—1 |
| W-7405-ENG-48 | California Univ., Livermore (USA). Lawrenc Livermore Lab. | |
| | 3:21105 | UCRL—52256(Pt.2) |
| | 3:21108 | UCID—17682 |
| | 3:21182 | UCRL—13804 |
| | 3:21222 | UCRL—13733-5 |
| | 3:21236 | UCRL—79442 |
| | 3:21237 | UCRL—79772 |
| | 3:21248 | UCID—17590 |
| | 3:21311 | TID—27702 |
| | 3:21313 | UCID—17535 |
| | 3:21400 | LBL—7000 |
| | 3:21433 | UCID—17632 |
| | 3:21449 | TID—28010 |
| | 3:21458 | UCID—17677 |
| | 3:21649 | UCID—17661 |
| | 3:21650 | UCID—17662 |
| | 3:21857 | UCRL—52346 |
| | 3:21883 | LBL—6906 |
| | 3:21894 | UCID—17665 |
| | 3:21895 | UCID—17666 |
| | 3:21918 | UCID—15644-77-3 |
| | 3:21947 | LBL—6699 |
| | 3:21976 | LBL—6682 |
| | 3:21999 | LBL—6850 |
| | 3:22000 | LBL—7228 |
| | 3:22024 | UCID—17629 |
| | 3:22026 | UCRL—80419 |
| | 3:22068 | UCRL—79770 |
| | 3:22080 | UCRL—13718 |
| | 3:22100 | UCRL-Trans—1542 |

| Contract No. | Abstract No. | Report No. |
|---|---|---|
| | 3:22132 | M—078-02 |
| | 3:22201 | UCRL—51879(Pt.3) |
| | 3:22233 | LBL—5638 |
| | 3:22249 | UCRL—13782 |
| | 3:22312 | LBL—6017 |
| | 3:22323 | UCID—17680 |
| | 3:22390 | UCID—17669 |
| | 3:22403 | PUB—113(Vol.3) |
| | 3:22422 | UCID—17650 |
| | 3:22423 | UCRL—52339 |
| | 3:22424 | UCRL—79780 |
| | 3:22425 | UCRL—79782 |
| | 3:22451 | UCRL-Trans—11307 |
| | 3:22506 | LBL—6703 |
| | 3:22539 | UCRL—79653 |
| | 3:22540 | UCRL—79870 |
| | 3:22541 | UCRL—80075 |
| | 3:22542 | UCRL—80076 |
| | 3:22543 | UCRL—80475 |
| | 3:22596 | UCID—17691 |
| | 3:22602 | LBL—6382 |
| | 3:22608 | UCRL—80424 |
| | 3:22618 | LBL—6383 |
| | 3:22619 | LBL—6384 |
| | 3:22620 | UCRL—80384 |
| | 3:22621 | UCRL—80406 |
| | 3:22622 | UCRL—80408 |
| | 3:22623 | UCRL—80418 |
| | 3:22631 | UCRL-Trans—11297 |
| | 3:22639 | LBL—6768 |
| | 3:22642 | UCID—17555 |
| | 3:22643 | UCRL—79535 |
| | 3:22644 | UCRL—79736 |
| | 3:22645 | UCRL—79776 |
| | 3:22646 | UCRL—79779 |
| | 3:22647 | UCRL—79784 |
| | 3:22648 | UCRL—79787 |
| | 3:22649 | UCRL—79801 |
| | 3:22650 | UCRL—80104 |
| | 3:22651 | UCRL—80169 |
| | 3:22652 | UCRL—80249 |
| | 3:22653 | UCRL—80314 |
| | 3:22654 | UCRL—80322(Summ.) |
| | 3:22655 | UCRL-Trans—11308 |
| | 3:22688 | UCID—17613 |
| | 3:22691 | LBL—6142 |
| | 3:22694 | UCRL—52242 |
| | 3:22697 | UCRL—80171 |
| W-7405-ENG-82 | Ames Lab., Iowa (USA) | |
| | 3:20879 | IS—4310 |
| | 3:20880 | IS—4311 |
| | 3:20903 | IS-T—777 |
| | 3:21881 | IS-T—778 |
| | 3:21882 | IS-T—780 |
| | 3:21942 | IS-T—741 |

# REPORT NUMBER INDEX

The numbers assigned to all reports cited in the publication appear in the first column of the index. The citation numbers (volume:citation number) are included in the second column. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index.


| *Report No.* | *Abstract No.* | *Availability* |
|---|---|---|
| **AD-A-** | | |
| 042188 | 3:21870 | NTIS PCA05/MF A01 |
| 042253 | 3:21871 | NTIS PCA07/MF A01 |
| 042389 | 3:21671 | NTIS PCA03/MF A01 |
| 042443 | 3:21872 | NTIS PCA04/MF A01 |
| 042504 | 3:22017 | NTIS PCA03/MF A01 |
| 042515 | 3:22280 | NTIS PCA20/MF A01 |
| 042548 | 3:22307 | NTIS PCA03/MF A01 |
| 042702 | 3:21880 | |
| **AECL-** | | |
| 5816 | 3:21713 | Atomic Energy of Canada Ltd., Pinawa, Manitoba, Canada |
| **AED-Conf-** | | |
| 1977-053-004 | 3:21328 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| 1977-072-010 | 3:21771 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| **AERE-R-** | | |
| 8735 | 3:21168 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| **AeroChem-TN-** | | |
| 178 | 3:21278 | *See* ERDA/JPL/954777-77/1 |
| **ALO/3987-** | | |
| 1/2 | 3:21323 | Dep. NTIS, PC A09/MF A01 |
| 1/3 | 3:21324 | Dep. NTIS, PC A06/MF A01 |
| **ANL-** | | |
| 77-14 | 3:20922 | Dep. NTIS, PC A07/MF A01 |
| **ANL/CES/TE-** | | |
| 77-1 | 3:21846 | Dep. NTIS, PC A05/MF A01 |
| 77-4 | 3:21847 | Dep. NTIS, PC A05/MF A01 |
| **ANL/CTIU/FE-** | | |
| 005 | 3:20923 | Dep. NTIS, PC A02/MF A01 |
| **ANL/ES-** | | |
| 61 | 3:22210 | Dep. NTIS, PC A05/MF A01 |
| **ARH-LD-** | | |
| 162 | 3:22223 | Dep. NTIS, PC A04/MF A01 |
| **BDX-** | | |
| 613-1634(Rev.) | 3:21873 | Dep. NTIS, PC A03/MF A01 |
| 613-1691(Rev.) | 3:21910 | Dep. NTIS, PC A03/MF A01 |
| 613-1875 | 3:22077 | Dep. NTIS, PC A02/MF A01 |
| 613-1945 | 3:22138 | Dep. NTIS, PC A03/MF A01 |
| **BERC-** | | |
| 0020-9 | 3:20874 | Dep. NTIS, PC A02/MF A01 |
| **BERC/RI-** | | |
| 77/13 | 3:21860 | Dep. NTIS, PC A02/MF A01 |
| 77/16 | 3:20949 | Dep. NTIS, PC A03/MF A01 |
| **BERC/TPR-** | | |
| 77/11 | 3:20950 | Dep. NTIS, PC A02/MF A01 |
| 78/1 | 3:22090 | Dep. NTIS, PC A02/MF A01 |
| **BM-IC-** | | |
| 8734 | 3:20958 | *See* PB-269951 |
| 8738 | 3:20917 | *See* PB-269914 |
| **BM-RI-** | | |
| 8262 | 3:20918 | Bureau of Mines, Washington, DC |
| **BM-Tape-** | | |
| 4-77(KWDX-577-MP) | 3:21691 | *See* PB-269451 |
| **BMFT-FB-T-** | | |
| 77-08 | 3:21840 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| **BNL-** | | |
| 22677 | 3:21679 | Dep. NTIS, PC A05/MF A01 |
| 23389 | 3:22613 | Dep. NTIS, PC A02/MF A01 |
| 23391 | 3:22614 | Dep. NTIS, PC A02/MF A01 |
| 23493 | 3:22120 | Dep. NTIS, PC A02/MF A01 |
| 50501-R | 3:21677 | Dep. NTIS, PC A19/MF A01 |
| **BNWL-** | | |
| 2004-6 | 3:21758 | Dep. NTIS, PC A06/MF A01 |
| 2260-3 | 3:22013 | Dep. NTIS, PC A03/MF A01 |
| **BNWL-SA-** | | |
| 5934 | 3:21422 | Richland, WA; Battelle Pacific Northwest Labs. (1976). |
| **BNWL-tr-** | | |
| 277 | 3:21876 | Dep. NTIS, PC A02/MF A01 |
| 279 | 3:21931 | Dep. NTIS, PC A02/MF A01 |
| **CAPE-** | | |
| 2607 | 3:21362 | EM |
| **CED-** | | |
| 77-79 | 3:21803 | *See* PB-269746 |
| 77-88 | 3:21692 | *See* PB-269803 |
| 77-92 | 3:21688 | *See* PB-269748 |
| **CENPD-** | | |
| 258 | 3:21634 | Combustion Engineering, Inc., Windsor, CT |
| **CONF-721247-** | | (12. session of the sub-committee on energy resources and electric power, Bangkok, Thailand, 6-13 Dec 1972) |
| | 3:21745 | New York; United Nations (1974). $12.00 |
| **CONF-730650-** | | (American Institute of Biological Sciences meeting, Amherst, MA, USA, 21 Jun 1973) |
| P1 | 3:21542 | Millbrook, NY; Cary Arboretum of the New York Botanical Gardens (1973). $8.00 |
| **CONF-750386-** | | (Conference on prevention and control of oil pollution, San Francisco, CA, USA, 25-27 Mar 1975) |
| | 3:21020 | Washington, DC; American Petroleum Inst. (1975). |
| **CONF-751266-** | | (14. IEEE decision and control conference on adaptive processes, Houston, TX, USA, 10-12 Dec 1975) |
| | 3:21469 | Piscataway, NJ; IEEE, Inc. (1975). $32.00 |
| **CONF-760159-** | | (Conference on focusing on energy, Lexington, KY, USA, 22-23 Jan 1976) |
| | 3:21708 | *See* IMMR-24-M3-76 |
| **CONF-7603113-** | | (Gas conditioning conference, Norman, OK, USA, 8-10 Mar 1976) |
| | 3:21067 | Univ. of Oklahoma, Norman, $10.00 |
| **CONF-760622-** | | (American Nuclear Society 1976 annual meeting, Toronto, Ontario, Canada, 13-18 Jun 1976) |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 63 | 3:22379 | *See* RLO/2225/T3-6 |
| CONF-760673- | (Workshop on correlation of neutron and charged particle damage, Oak Ridge, TN, USA, 8-9 Jun 1976) | |
| 3 | 3:22680 | *See* HEDL-SA-1252 |
| CONF-760678- | (Meeting of the Society of Automotive Engineers on combined fuels and powerplant, St. Louis, MO, USA, 8-10 Jun 1976) | |
| 29 | 3:21255 | Warrendale, PA; Society of Automotive Engineers (1976). |
| CONF-7606160- | (72. regular meeting of the Rocky Mountain Coal Mining Institute, Vail, CO, USA, 27-30 Jun 1976) | |
| | 3:21725 | Rocky Mountain Coal Mining Inst., Denver |
| CONF-760735- | (US/USSR steam generator seminar, Dimitrovgrad, USSR, 26-30 Jul 1976) | |
| 1 | 3:21578 | Dep. NTIS, PC A02/MF A01 |
| CONF-760832- | (20. annual SPIE technical symposium, San Diego, CA, USA, 24-25 Aug 1976) | |
| P2 | 3:22065 | Palos Verdes Estates, CA; Society of Photo-Optical Instrumentation Engineers (1977). $34.00 |
| CONF-760887- | (Symposium on new advances in isotope separation, San Francisco, CA, USA, Aug 1976) | |
| 2 | 3:21140 | *See* COO-3498-30 |
| CONF-760889- | (International conference on photo conversion and storage of solar energy, London, Ontario, Canada, 24-28 Aug 1976) | |
| | 3:21312 | Dep. NTIS, PC A06/MF A01 |
| CONF-7609141- | (6. international symposium on gallium arsenide and related compounds, Edinburgh, UK, 20-22 Sep 1976) | |
| | 3:22056 | American Inst. of Physics, New York |
| CONF-7609148- | (6. international symposium on gallium arsenide and related compounds, St. Louis, MO, USA, 26-29 Sep 1976) | |
| | 3:22061 | American Inst. of Physics, New York |
| CONF-761027- | (International conference on properties on atomic defects on metals, Argonne, IL, USA, 18-22 Oct 1976) | |
| 25 | 3:21877 | Dep. NTIS, PC A03/MF A01 |
| 26 | 3:22317 | Dep. NTIS, PC A02/MF A01 |
| CONF-761061- | (14. international symposium for the application for computers and mathematics in the mineral industries, University Park, PA, USA, 4-8 Oct 1976) | |
| | 3:21690 | Pennsylvania State Univ., University Park |
| CONF-761160- | (Consultants meeting on integral cross section measurements in standard neutron fields, Vienna, Austria, 15-19 Nov 1976) | |
| 2 | 3:22378 | *See* HEDL-SA-1148(Rev.1) |
| CONF-761191- | (Conference on fabrication and reliability of welded process plant, London, UK, 16-18 Nov 1976) | |
| | 3:21513 | Cambridge, England; Welding Institute (1977). |
| CONF-761209- | (2. international conference of submillimeter waves and their applications, San Juan, Puerto Rico, Dec 1976) | |
| | 3:22067 | New York; Institute of Electrical and Electronics Engineers (1976). |
| CONF-761219- | (12. international congress of hydrothermal techniques, Buenos Aires, Argentina, 12-21 Dec 1976) | |
| | 3:21394 | Dep. NTIS (US Sales Only), PC A06/MF A01 |
| (Absts.) | 3:21385 | Dep. NTIS (US Sales Only), PC A04/MF A01 |
| CONF-761243- | (3. Latin American Congress on thermalism, Buenos Aires, Argentina, 12-21 Dec 1976) | |
| | 3:21394 | *See* CONF-761219- |
| (Absts.) | 3:21385 | *See* CONF-761219-(Absts.) |
| CONF-770231- | (Radon workshop, New York, NY, USA, Feb 1977) | |
| | 3:22163 | *See* HASL-325 |
| CONF-770235- | (Thermochemical coordination meeting-fuel from biomass program, Lubbock, TX, USA, 23 Feb 1977) | |
| | 3:21302 | Dep. NTIS, PC A08/MF A01 |
| CONF-770338- | (Isabelle workshop, Upton, NY, USA, 30 Mar-1 Apr 1977) | |
| 3 | 3:22341 | *See* FERMILAB-Conf-77/66-THY |
| CONF-770375- | (56. annual convention of the Gas Processors Association, Dallas, TX, USA, 21-23 Mar 1977) | |
| | 3:21060 | Gas Processors Association, Tulsa, OK |
| CONF-770383- | (Review meeting on salt dissolution, Austin, TX, USA, 29-30 Mar 1977) | |
| | 3:21189 | *See* Y/OWI/SUB-77/16537 |
| CONF-770389- | (United Nations conference on water resources, Mar de Plata, Argentina, 14-25 Mar 1977) | |
| 1 | 3:21481 | *See* ORNL-tr-4519 |
| CONF-770406- | (5. international conference on experimental meson spectroscopy, Boston, MA, USA, 29-30 Apr 1977) | |
| 4 | 3:22350 | *See* FERMILAB-Conf-77/65-THY |
| CONF-770582- | (Karcher symposium on energy and the chemical sciences, Norman, OK, USA, 7 May 1977) | |
| 1 | 3:21308 | Dep. NTIS, PC A04/MF A01 |
| CONF-770590- | (Meeting of the Seismological Society, Tokyo, Japan, 12-14 May 1977) | |
| 3 | 3:21399 | Tokyo; Seismological Society of Japan (1977). |
| CONF-770593- | (Conference on fusion energy applied to synthetic fuel production, Germantown, MD, USA, 9-10 May 1977) | |
| | 3:21243 | Dep. NTIS, PC A06/MF A01 |
| CONF-770640- | (7. liquid metal boiling working group meeting, Petten, Netherlands, 1-3 Jun 1977) | |
| 2 | 3:21592 | *See* JAPFNR-263 |
| 3 | 3:21658 | *See* JAPFNR-262 |
| CONF-770658- | (Fuel switching forum, Pittsburgh, PA, USA, 6-7 Jun 1977) | |
| | 3:20924 | Dep. NTIS, PC A13/MF A01 |
| CONF-770697- | (8. international symposium on multi-particle dynamics, Kaysersberg, France, 12-19 Jun 1977) | |
| 4 | 3:22381 | *See* SLAC-PUB-2010 |
| CONF-7706100- | (Fossil energy research meeting, Washington, DC, USA, 28-29 Jun 1977) | |
| | 3:20841 | Dep. NTIS, PC A24/MF A01 |
| CONF-7706101- | (6. annual conference council for educational development and research, Washington, DC, USA, 22-24 Jun 1977) | |
| | 3:21678 | Dep. NTIS, PC A13/MF A01 |
| CONF-7706104- | (IEEE conference, Chicago, IL, USA, Jun 1977) | |
| 1 | 3:22689 | Dep. NTIS, PC A02/MF A01 |
| CONF-7706105- | (2. NATO-CCMS meeting on dry hot rock geothermal energy, Los Alamos, NM, USA, 28-30 Jun 1977) | |
| (Summ.) | 3:21448 | *See* LA-7021-C |
| CONF-770709- | (10. international conference on high energy accelerators, Serpukhov, USSR, 11-17 Jul 1977) | |
| 16 | 3:22100 | *See* UCRL-Trans-1542 |
| CONF-770753- | (Isabelle workshop, Upton, NY, USA, 18-29 Jul 1977) | |
| 2 | 3:22120 | *See* BNL-23493 |
| CONF-770814- | (American Chemical Society meeting, Chicago, IL, USA, 29 Aug-2 Sep 1977) | |
| 10 | 3:20875 | Dep. NTIS, PC A02/MF A01 |
| CONF-770881- | (Gordon research conference/laser interaction with matter, Tilton, NH, USA, 8-12 Aug 1977) | |
| 1 | 3:22644 | *See* UCRL-79736 |
| CONF-770906- | (8. European conference on controlled fusion and plasma physics, Prague, Czechoslovakia, 19-23 Sep 1977) | |
| 9 | 3:22540 | *See* UCRL-79870 |
| CONF-770931- | (7. international conference on atomic collisions in solids, Moscow, F.R. Germany, 19-23 Sep 1977) | |
| 4 | 3:22311 | Dep. NTIS, PC A04/MF A01 |
| CONF-770935- | (5. international conference on vacuum ultraviolet radiation physics, Montpellier, France, 5-9 Sep 1977) | |
| 4 | 3:22314 | Dep. NTIS, PC A02/MF A01 |
| CONF-770954- | (2. conference on hot plasma diagnostics, Kharkov, USSR, 22-27 Sep 1977) | |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 4 | 3:22421 | *See* SAND-77-1829C |
| 5 | 3:22419 | Dep. NTIS, PC A02/MF A01 |
| CONF-770957- | (13. European congress on molecular spectroscopy, Wroclaw, Poland, 12-16 Sep 1977) | |
| 1 | 3:21948 | *See* ORO-1797-76 |
| CONF-770961- | (Microbiology of power plant thermal effluents, Iowa City, IA, USA, 19-20 Sep 1977) | |
| 3 | 3:22228 | Dep. NTIS, PC A02/MF A01 |
| CONF-770971- | (21. general conference of the International Atomic Energy Agency, Vienna, Austria, 26 Sep 1977) | |
| 1 | 3:21704 | Dep. NTIS, PC A02/MF A01 |
| CONF-771023- | (Nuclear science symposium, San Francisco, CA, USA, 19-21 Oct 1977) | |
| 23 | 3:21579 | Dep. NTIS, PC A02/MF A01 |
| CONF-771024- | (NCA/BCR coal conference, Louisville, KY, USA, 19 Oct 1977) | |
| 3 | 3:21522 | Dep. NTIS, PC A02/MF A01 |
| CONF-771029- | (7. symposium on fusion research project, Knoxville, TN, USA, 25-29 Oct 1977) | |
| 147 | 3:22615 | Dep. NTIS, PC A02/MF A01 |
| 149 | 3:22591 | Dep. NTIS, PC A02/MF A01 |
| 150 | 3:22534 | Dep. NTIS, PC A02/MF A01 |
| 153 | 3:22607 | Dep. NTIS, PC A02/MF A01 |
| 172 | 3:22602 | *See* LBL-6382 |
| 174 | 3:22605 | *See* WFPS-TME-064 |
| 175 | 3:22619 | *See* LBL-6384 |
| 176 | 3:22618 | *See* LBL-6383 |
| 180 | 3:22592 | Dep. NTIS, PC A02/MF A01 |
| 182 | 3:22676 | Dep. NTIS, PC A02/MF A01 |
| 184 | 3:22593 | Dep. NTIS, PC A02/MF A01 |
| 185 | 3:22613 | *See* BNL-23389 |
| 186 | 3:22614 | *See* BNL-23391 |
| 187 | 3:22630 | *See* WFPS-TME-068 |
| 188 | 3:22616 | Dep. NTIS, PC A02/MF A01 |
| 189 | 3:22577 | Dep. NTIS, PC A02/MF A01 |
| 190 | 3:22535 | Dep. NTIS, PC A02/MF A01 |
| 193 | 3:22594 | Dep. NTIS, PC A02/MF A01 |
| 196 | 3:22544 | *See* WFPS-TME-062 |
| 197 | 3:22580 | *See* WFPS-TME-060 |
| 199 | 3:22595 | Dep. NTIS, PC A02/MF A01 |
| 200 | 3:22597 | *See* WFPS-TME-059 |
| CONF-771035- | (2. international topical conference, Ithaca, NY, USA, 3-5 Oct 1977) | |
| 16 | 3:22639 | *See* LBL-6768 |
| CONF-771036- | (2. ASTM-EURATOM symposium on reactor dosimetry: dosimetry methods for fuels, cladding and structural materials, Palo Alto, CA, USA, 2-7 Oct 1977) | |
| 6 | 3:22677 | Dep. NTIS, PC A02/MF A01 |
| CONF-771040- | (Electro-Optical systems conference, Anaheim, CA, USA, 25-27 Oct 1977) | |
| 7 | 3:22652 | *See* UCRL-80249 |
| 8 | 3:22643 | *See* UCRL-79535 |
| CONF-771055- | (Congress of international technology, Pittsburgh, PA, USA, 9-14 Oct 1977) | |
| 1 | 3:22139 | Dep. NTIS, PC A02/MF A01 |
| CONF-771056- | (IAEA conference and workshop on fusion reactor design, Madison, WI, USA, 12 Oct 1977) | |
| 5 | 3:22541 | *See* UCRL-80075 |
| 9 | 3:22542 | *See* UCRL-80076 |
| CONF-771061- | (Symposium on optical materials for high power lasers, Boulder, CO, USA, 4-6 Oct 1977) | |
| 4 | 3:22026 | *See* UCRL-80419 |
| CONF-771062- | (OECD/NEA working group on nuclear information, Berkeley, CA, USA, 5-7 Oct 1977) | |
| 4 | 3:22697 | *See* UCRL-80171 |
| CONF-771067- | (National safety congress, Chicago, IL, USA, 18 Oct 1977) | |
| 1 | 3:21271 | *See* SAND-77-1412C |
| CONF-771072- | (3. international conference on nuclear methods in environmental and energy research, Columbia, MO, USA, 10-12 Oct 1977) | |
| 3 | 3:20887 | Dep. NTIS, PC A02/MF A01 |
| CONF-771080- | (International symposium on neutron inelastic scattering, Vienna, Austria, 17-21 Oct 1977) | |
| 2 | 3:21901 | Dep. NTIS, PC A02/MF A01 |
| CONF-771084- | (Ecosystems workshop, Santa Rosa, CA, USA, 25 Oct 1977) | |
| 1 | 3:21433 | *See* UCID-17632 |
| CONF-771089- | (Particles and fields meeting, Argonne, IL, USA, 6-8 Oct 1977) | |
| 3 | 3:22347 | *See* SLAC-PUB-2051 |
| CONF-7710101- | (5. national conference on energy and the environment, Cincinnati, OH, USA, 31 Oct-3 Nov 1977) | |
| 1 | 3:21739 | Dep. NTIS, PC A02/MF A01 |
| 3 | 3:21524 | Dep. NTIS, PC A02/MF A01 |
| 4 | 3:20911 | Dep. NTIS, PC A02/MF A01 |
| 5 | 3:21740 | Dep. NTIS, PC A02/MF A01 |
| CONF-771102- | (20. annual AICHE meeting, New York, NY, USA, 13-17 Nov 1977) | |
| 14 | 3:22539 | *See* UCRL-79653 |
| 17 | 3:22068 | *See* UCRL-79770 |
| CONF-771109- | (ANS winter meeting, San Francisco, CA, USA, 27 Nov-2 Dec 1977) | |
| | 3:21554 | 27: 1-1028(1977) |
| 38 | 3:21625 | *See* SAND-77-1116C |
| 57 | 3:22536 | Dep. NTIS, PC A02/MF A01 |
| 65 | 3:22537 | Dep. NTIS, PC A02/MF A01 |
| 70 | 3:22011 | *See* DP-MS-77-49 |
| 71 | 3:22679 | *See* DP-MS-77-47 |
| 84 | 3:22678 | Dep. NTIS, PC A03/MF A01 |
| 85 | 3:22404 | Dep. NTIS, PC A02/MF A01 |
| CONF-771136- | (Annual American Physical Society meeting, Atlanta, GA, USA, 7-11 Nov 1977) | |
| 8 | 3:21237 | *See* UCRL-79772 |
| 9 | 3:22648 | *See* UCRL-79787 |
| 11 | 3:22646 | *See* UCRL-79779 |
| 12 | 3:22649 | *See* UCRL-79801 |
| 13 | 3:22647 | *See* UCRL-79784 |
| 14 | 3:22645 | *See* UCRL-79776 |
| 15 | 3:22654 | *See* UCRL-80322(Summ.) |
| 16 | 3:22425 | *See* UCRL-79782 |
| 18 | 3:22424 | *See* UCRL-79780 |
| 19 | 3:22653 | *See* UCRL-80314 |
| CONF-771145- | (Workshop on valves for solids handling service in coal conversion, Morgantown, WV, USA, 14-16 Nov 1977) | |
| 2 | 3:20849 | Dep. NTIS, PC A02/MF A01 |
| CONF-771206- | (Digital signal processing symposium, Albuquerque, NM, USA, 6-7 Dec 1977) | |
| 23 | 3:22129 | *See* SAND-77-1914C |
| CONF-771213- | (Plasma heating development requirements workshop, Gaithersburg, MD, USA, 5-7 Dec 1977) | |
| 1 | 3:22620 | *See* UCRL-80384 |
| 2 | 3:22623 | *See* UCRL-80418 |
| 4 | 3:22622 | *See* UCRL-80408 |
| 5 | 3:22543 | *See* UCRL-80475 |
| 7 | 3:22621 | *See* UCRL-80406 |
| CONF-780109- | (Technology for energy conservation, Albuquerque, NM, USA, 23-27 Jan 1978) | |
| 1 | 3:20935 | *See* MLM-2497(OP) |
| CONF-780202- | (Topical meeting on inertial confinement fusion, San Diego, CA, USA, 7 Feb 1978) | |
| 1 | 3:22640 | *See* SAND-77-1495C |
| 3 | 3:22636 | *See* COO-2007-92 |
| 4 | 3:22641 | *See* SAND-77-1592C |
| 7 | 3:21236 | *See* UCRL-79442 |
| 8 | 3:22650 | *See* UCRL-80104 |
| 9 | 3:22651 | *See* UCRL-80169 |
| 10 | 3:22637 | *See* COO-4251-5 |
| CONF-780204- | (Proceedings of the 8th annual meeting, Jacksonville, FL, USA, 15-17 Feb 1978) | |
| 1 | 3:22002 | *See* SAND-77-1436C |
| CONF-780303- | (IEEE vehicular technology conference, Denver, CO, USA, 24 Mar 1978) | |
| 1 | 3:21859 | *See* SAND-78-0030C |
| CONF-780305- | (Division of fuel chemistry meeting, Anaheim, CA, USA, 12-17 Mar 1978) | |
| 1 | 3:20850 | Dep. NTIS, PC A02/MF A01 |
| CONF-780308- | (NACE meeting on corrosion, Houston, TX, USA, 6-10 Mar 1978) | |
| 3 | 3:22608 | *See* UCRL-80424 |
| CONS/1011- | | |
| 21 | 3:21856 | Dep. NTIS, PC A02/MF A01 |
| COO- | | |
| 38-1838 | 3:22264 | Dep. NTIS, PC A02/MF A01 |
| 913-68 | 3:21992 | Dep. NTIS, PC A02/MF A01 |
| 1545-222 | 3:22326 | Dep. NTIS, PC A03/MF A01 |
| 2007-92 | 3:22636 | Dep. NTIS, PC A02/MF A01 |
| 2250-30 | 3:21580 | Dep. NTIS, PC A02/MF A01 |
| 2307-13 | 3:22198 | Dep. NTIS, PC A02/MF A01 |
| 2362-27 | 3:22252 | Dep. NTIS, PC A02/MF A01 |
| 2363-4 | 3:22268 | Dep. NTIS, PC A02/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 2383-45 | 3:22690 | Dep. NTIS, PC A03/MF A01 |
| 2477-13(Vol.1) | 3:21596 | Dep. NTIS, PC A17/MF A01 |
| 2631-22 | 3:21855 | Dep. NTIS, $7.25 |
| 2765-7 | 3:22617 | Dep. NTIS, PC A02/MF A01 |
| 2837-3 | 3:21975 | Dep. NTIS, PC A02/MF A01 |
| 2898-10 | 3:20888 | Dep. NTIS, PC A02/MF A01 |
| 3267-15 | 3:22238 | Dep. NTIS, PC A02/MF A01 |
| 3498-30 | 3:21140 | Dep. NTIS, PC A02/MF A01 |
| 3568-18 | 3:22220 | Dep. NTIS, PC A03/MF A01 |
| 4030-4 | 3:22018 | Dep. NTIS, PC A04/MF A01 |
| 4246-2 | 3:21878 | Dep. NTIS, PC A03/MF A01 |
| 4251-4 | 3:22019 | Dep. NTIS, PC A02/MF A01 |
| 4251-5 | 3:22637 | Dep. NTIS, PC A02/MF A01 |
| **COO/0029-** | | |
| 1 | 3:20951 | Dep. NTIS, PC A08/MF A01 |
| **COO/2608-** | | |
| 1 | 3:21367 | Dep. NTIS, PC A09/MF A01 |
| **COO/2627-** | | |
| 2 | 3:21329 | Dep. NTIS, PC A09/MF A01 |
| **COO/2789-** | | |
| 1 | 3:21784 | Dep. NTIS, PC A02/MF A01 |
| **COO/4098-** | | |
| 1 | 3:20952 | Dep. NTIS, PC A10/MF A01 |
| **COO/4188-** | | |
| 2 | 3:21472 | Dep. NTIS, PC A04/MF A01 |
| **COO/4295-** | | |
| 1 | 3:21141 | Dep. NTIS, PC A02/MF A01 |
| **COO/4490-** | | |
| 1 | 3:21772 | Dep. NTIS, PC A02/MF A01 |
| **CRBRP-ARD-** | | |
| 0147 | 3:21581 | AT |
| 0185(Vol.1) | 3:21635 | AT |
| 0188 | 3:21582 | AT |
| **CW-WR-** | | |
| 76-028.2 | 3:21854 | *See* N-77-26134 |
| **DOE/ERA-** | | |
| 0031 | 3:21714 | Dep. NTIS, PC A09/MF A01 |
| **DOE/ET-** | | |
| 0002 | 3:22538 | Dep. NTIS, PC A02/MF A01 |
| 0009 | 3:21636 | Dep. NTIS, PC A14/MF A01 |
| **DOE/EV-** | | |
| 0004 | 3:21162 | Dep. NTIS, PC A02/MF A01 |
| 0005-1 | 3:21208 | Dep. NTIS, PC A06/MF A01 |
| 0030 | 3:22230 | Dep. NTIS, PC A05/MF A01 |
| **DOE/JPL/2616-** | | |
| 2 | 3:20852 | Dep. NTIS, PC A03/MF A01 |
| **DOE/PE-** | | |
| 0001 | 3:22144 | Dep. NTIS, PC A08/MF A01 |
| **DOE-tr-** | | |
| 30 | 3:21516 | Dep. NTIS, PC A02/MF A01 |
| 45 | 3:21839 | Dep. NTIS, PC A04/MF A01 |
| 49 | 3:21195 | Dep. NTIS, PC A05/MF A01 |
| **DP-** | | |
| 1468 | 3:21165 | Dep. NTIS, PC A03/MF A01 |
| 1476 | 3:21180 | Dep. NTIS, PC A03/MF A01 |
| **DP-MS-** | | |
| 77-47 | 3:22679 | Dep. NTIS, PC A02/MF A01 |
| 77-49 | 3:22011 | Dep. NTIS, PC A02/MF A01 |
| **DPST-** | | |
| 77-146-2 | 3:21118 | Dep. NTIS, PC E11/MF A01 |
| 77-363 | 3:21119 | Dep. NTIS, PC A05/MF A01 |
| **DSE/2426-** | | |
| 19 | 3:21326 | Dep. NTIS, PC A06/MF A01 |
| **E-** | | |
| 1569-143 | 3:22324 | *See* TID-27646 |
| 9148 | 3:21279 | *See* N-77-26222 |
| **EMD-** | | |
| 77-21 | 3:21748 | *See* PB-269614 |
| 77-22 | 3:21266 | *See* PB-269254 |
| 77-46 | 3:21701 | *See* PB-269745 |
| 77-51 | 3:21729 | *See* PB-269865 |
| **EML-** | | |
| 334 | 3:22152 | Dep. NTIS, MF A01 |
| 334(App.) | 3:22205 | Dep. NTIS, PC A10/MF A01 |
| **EPA-** | | |
| 600/3-77/048 | 3:21988 | *See* PB-269858 |
| 905/4-77/002 | 3:22213 | *See* PB-269902 |
| **EPRI-AF-** | | |
| 234 | 3:20876 | Dep. NTIS, PC A06/MF A01 |
| 558 | 3:20853 | Dep. NTIS, PC A03/MF A01 |
| **EPRI-EL-** | | |
| 220 | 3:21549 | Dep. NTIS, PC A08/MF A01 |
| 482 | 3:21529 | Dep. NTIS, PC A07/MF A01 |
| 588 | 3:21530 | Dep. NTIS, PC A10/MF A01 |
| **EPRI-ER-** | | |
| 582 | 3:22578 | Dep. NTIS, PC A12/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **EPRI-FP-** | | |
| 291(Vol.1) | 3:20899 | Dep. NTIS, PC A03/MF A01 |
| 291(Vol.2) | 3:20900 | Dep. NTIS, PC A12/MF A01 |
| **EPRI-NP-** | | |
| 135 | 3:21637 | Dep. NTIS, PC A09/MF A01 |
| 385(Vol.1) | 3:21638 | Dep. NTIS, PC A03/MF A01 |
| 474 | 3:21639 | Dep. NTIS, PC A04/MF A01 |
| 567 | 3:21556 | Dep. NTIS, PC A06/MF A01 |
| **ERDA-** | | |
| 77-34 | 3:21218 | Dep. NTIS, PC A05/MF A01 |
| 1547(Vol.2) | 3:20912 | Dep. NTIS, PC A10/MF E01 |
| **ERDA/JPL/954356-** | | |
| 77/3 | 3:21273 | Dep. NTIS, PC A06/MF A01 |
| **ERDA/JPL/954374-** | | |
| 77/3 | 3:21274 | Dep. NTIS, PC A05/MF A01 |
| **ERDA/JPL/954458-** | | |
| 77/6 | 3:21275 | Dep. NTIS, $4.00 |
| **ERDA/JPL/954471-** | | |
| 77/3 | 3:21276 | Dep. NTIS, PC A03/MF A01 |
| **ERDA/JPL/954605-** | | |
| 77/3 | 3:21277 | Dep. NTIS, PC A03/MF A01 |
| **ERDA/JPL/954777-** | | |
| 77/1 | 3:21278 | Dep. NTIS, PC A02/MF A01 |
| **ERDA-tr-** | | |
| 316 | 3:22416 | Dep. NTIS, PC A02/MF A01 |
| **FE-** | | |
| 1231-9 | 3:20916 | Dep. NTIS, $5.25 |
| 1234-8 | 3:20877 | Dep. NTIS, PC A19/MF A01 |
| 1511-39 | 3:20927 | Dep. NTIS, PC A05/MF A01 |
| 1518-46 | 3:21252 | Dep. NTIS, PC A13/MF A01 |
| 1770-26 | 3:20854 | Dep. NTIS, PC A03/MF A01 |
| 2011-9 | 3:20878 | Dep. NTIS, PC A04/MF A01 |
| 2015-12 | 3:21752 | Dep. NTIS, PC A04/MF A01 |
| 2015-20 | 3:20855 | Dep. NTIS, PC A05/MF A01 |
| 2015-21 | 3:21753 | Dep. NTIS, PC A07/MF A01 |
| 2030-8 | 3:20889 | Dep. NTIS, PC A03/MF A01 |
| 2205-7 | 3:20890 | Dep. NTIS, PC A02/MF A01 |
| 2205-8 | 3:20901 | Dep. NTIS, PC A02/MF A01 |
| 2215-7 | 3:21754 | Dep. NTIS, PC A08/MF A01 |
| 2243-9 | 3:21764 | Dep. NTIS, PC A05/MF A01 |
| 2276-6 | 3:21257 | Dep. NTIS, PC A05/MF A01 |
| 2288-16 | 3:20928 | Dep. NTIS, PC A02/MF A01 |
| 2292-9 | 3:21485 | Dep. NTIS, PC A05/MF A01 |
| 2295-1 | 3:21759 | Dep. NTIS, PC A04/MF A01 |
| 2341-2 | 3:21765 | Dep. NTIS, PC A04/MF A01 |
| 2343-45 | 3:21726 | Dep. NTIS, PC A04/MF A01 |
| 2355-2(Rev.D) | 3:20856 | Dep. NTIS, PC A03/MF A01 |
| 2414-4 | 3:20857 | Dep. NTIS, PC A03/MF A01 |
| 2435-19 | 3:21253 | Dep. NTIS, PC A03/MF A01 |
| 2467-4 | 3:20858 | Dep. NTIS, PC A06/MF A01 |
| 2479-1 | 3:20840 | Dep. NTIS, PC A05/MF A01 |
| 2515-10 | 3:20953 | Dep. NTIS, PC A07/MF A01 |
| 2579-10 | 3:20902 | Dep. NTIS, PC A04/MF A01 |
| 5065-2 | 3:20891 | Dep. NTIS, PC A02/MF A01 |
| **FE/2660-** | | |
| 1 | 3:21723 | Dep. NTIS, PC A11/MF A01 |
| **FE/2692-** | | |
| 1 | 3:20892 | Dep. NTIS, PC A02/MF A01 |
| **FEA/D-** | | |
| 76/229(Vol.1) | 3:21793 | Dep. NTIS, PC A03/MF A01 |
| 77/140 | 3:21749 | Dep. NTIS, PC A05/MF A01 |
| **FEA/G-** | | |
| 77/356 | 3:20937 | NTIS, MF A01 |
| 77/357 | 3:20938 | NTIS, MF A01 |
| **FEA/N-** | | |
| 77/115 | 3:21715 | *See* PB-268850 |
| **FERMILAB-Conf-** | | |
| 77/65-THY | 3:22350 | Dep. NTIS, PC A03/MF A01 |
| 77/66-THY | 3:22341 | Dep. NTIS, PC A03/MF A01 |
| **FR-** | | |
| 8400 | 3:21872 | *See* AD-A-042443 |
| **GA-A-** | | |
| 13557 | 3:21571 | Dep. NTIS, PC A04/MF A01 |
| 13723 | 3:21572 | Dep. NTIS, PC A06/MF A01 |
| 14121 | 3:21583 | Dep. NTIS, PC A05/MF A01 |
| 14613 | 3:21584 | Dep. NTIS, PC A12/MF A01 |
| 14678 | 3:21151 | Dep. NTIS, PC A07/MF A01 |
| 14684 | 3:21573 | Dep. NTIS, PC A17/MF A01 |
| **GCA-TR-** | | |
| 75-37-G | 3:20929 | *See* PB-269556 |
| **GERHTR-** | | |
| 181 | 3:21158 | Dep. NTIS, PC A03/MF A01 |
| **GJBX-** | | |
| 3(78) | 3:21120 | Dep. NTIS, PC E03/MF A01 |
| 7(78) | 3:21121 | Dep. NTIS, PC E06/MF A01 |
| 9(78) | 3:21118 | *See* DPST-77-146-2 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 78(77) | 3:21122 | NTIS, MF A01 |
| 80(77) | 3:21119 | *See* DPST-77-363 |
| 82(77) | 3:21123 | NTIS, MF A01 |
| 92(77) | 3:21124 | NTIS, MF A01 |
| **GJT-** | | |
| 18 | 3:22160 | Dep. NTIS, PC A08/MF A01 |
| 18S | 3:22161 | Dep. NTIS, PC A03/MF A01 |
| 20 | 3:22162 | Dep. NTIS, PC A07/MF A01 |
| 125 | 3:21201 | Dep. NTIS, PC A04/MF A01 |
| **HASL-** | | |
| 325 | 3:22163 | Dep. NTIS, PC A09/MF A01 |
| **HCP/M3879-** | | |
| 1(Vol.1) | 3:21681 | Dep. NTIS, PC A07/MF A01 |
| 1(Vol.2) | 3:21680 | Dep. NTIS, PC A15/MF A01 |
| 0003 | 3:21682 | Dep. NTIS, PC A03/MF A01 |
| **HCP/T6010-** | | |
| E1 | 3:21550 | Dep. NTIS, PC A04/MF A01 |
| **HEDL-SA-** | | |
| 1148(Rev.1) | 3:22378 | Dep. NTIS, PC A03/MF A01 |
| 1252 | 3:22680 | Dep. NTIS, PC A04/MF A01 |
| **HEDL-TME-** | | |
| 77-37 | 3:21585 | AT |
| 77-38 | 3:21586 | AT |
| 77-81 | 3:22681 | Dep. NTIS, PC A03/MF A01 |
| **HI-** | | |
| 2451/3-P | 3:21061 | Hudson Institute, Inc., Croton-on-Hudson, NY, $7.00 |
| **HRD-** | | |
| 77-77 | 3:21689 | *See* PB-269875 |
| **HRP-** | | |
| 0006691 | 3:21209 | |
| 0006798 | 3:21210 | |
| **ICP-** | | |
| 1132 | 3:21169 | Dep. NTIS, PC A09/MF A01 |
| 1136 | 3:21170 | Dep. NTIS, PC A11/MF A01 |
| **IMMR-** | | |
| 24-M3-76 | 3:21708 | Inst. for Mining and Minerals Research, Lexington, KY |
| **INIS-mf-** | | |
| 3355 | 3:22454 | Dep. NTIS (US Sales Only), MF A01 |
| **IS-** | | |
| 4310 | 3:20879 | Dep. NTIS, PC A04/MF A01 |
| 4311 | 3:20880 | Dep. NTIS, PC A03/MF A01 |
| **IS-T-** | | |
| 741 | 3:21942 | Dep. NTIS, PC A07/MF A01 |
| 777 | 3:20903 | Dep. NTIS, PC A05/MF A01 |
| 778 | 3:21881 | Dep. NTIS, PC A07/MF A01 |
| 780 | 3:21882 | Dep. NTIS, PC A08/MF A01 |
| **IS-Trans-** | | |
| 97 | 3:21973 | Dep. NTIS, PC A02/MF A01 |
| 99 | 3:22442 | Dep. NTIS, PC A02/MF A01 |
| **ISL-R-** | | |
| 116/76 | 3:22022 | *See* N-77-26490 |
| **JACKFAU-** | | |
| 77-173-1 | 3:21797 | *See* PB-269906 |
| **JAPFNR-** | | |
| 262 | 3:21658 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| 263 | 3:21592 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| **K-** | | |
| 76-124U(R)(Vol.2) | 3:21659 | Dep. NTIS, PC A06/MF A01 |
| **K/UR-** | | |
| 3(Pt.5) | 3:21125 | Dep. NTIS, PC A02/MF A01 |
| **KFK-** | | |
| 2431 | 3:21171 | Dep. NTIS (US Sales Only), PC A07/MF A01 |
| **KNUTAP-** | | |
| 5211-01-FR | 3:21683 | *See* PB-269497 |
| **LA-** | | |
| 6919 | 3:22103 | Dep. NTIS, PC A02/MF A01 |
| 6972 | 3:21432 | Dep. NTIS, PC A02/MF A01 |
| 6985 | 3:22078 | Dep. NTIS, PC A02/MF A01 |
| 7014-MS | 3:22638 | Dep. NTIS, PC A02/MF A01 |
| 7021-C | 3:21448 | Dep. NTIS, PC A05/MF A01 |
| 7023-PR | 3:22096 | Dep. NTIS, PC A03/MF A01 |
| 7034-MS | 3:22118 | Dep. NTIS, PC A02/MF A01 |
| 7037-PR | 3:21553 | Dep. NTIS, PC A02/MF A01 |
| 7062-MS | 3:21109 | Dep. NTIS, PC A03/MF A01 |
| 7077-T | 3:22114 | Dep. NTIS, PC A06/MF A01 |
| **LA-tr-** | | |
| 77-40 | 3:22113 | NTIS, MF A01 |
| 77-65 | 3:22137 | Dep. NTIS, PC A03/MF A01 |
| 77-67 | 3:22262 | Dep. NTIS, PC A02/MF A01 |
| 77-69 | 3:22447 | Dep. NTIS, PC A06/MF A01 |
| 77-70 | 3:22111 | Dep. NTIS, PC A02/MF A01 |
| 77-73A | 3:22261 | Dep. NTIS, PC A02/MF A01 |
| 77-74 | 3:22338 | Dep. NTIS, PC A02/MF A01 |
| 77-75 | 3:22253 | Dep. NTIS, PC A02/MF A01 |
| 77-76 | 3:22332 | Dep. NTIS, PC A02/MF A01 |
| 77-77B | 3:22263 | Dep. NTIS, PC A02/MF A01 |
| 77-86 | 3:22237 | Dep. NTIS, MF A01 |
| 77-87 | 3:22235 | Dep. NTIS, MF A01 |
| 77-88 | 3:22234 | Dep. NTIS, MF A01 |
| 77-89 | 3:22106 | NTIS, MF A01 |
| 77-93 | 3:22112 | NTIS, MF A01 |
| 77-94 | 3:22236 | Dep. NTIS, MF A01 |
| 84 | 3:22367 | Dep. NTIS, PC A02/MF A01 |
| **LBL-** | | |
| 5638 | 3:22233 | Dep. NTIS, PC A02/MF A01 |
| 6017 | 3:22312 | Dep. NTIS, PC A19/MF A01 |
| 6142 | 3:22691 | Dep. NTIS, PC A07/MF A01 |
| 6382 | 3:22602 | Dep. NTIS, PC A02/MF A01 |
| 6383 | 3:22618 | Dep. NTIS, PC A02/MF A01 |
| 6384 | 3:22619 | Dep. NTIS, PC A02/MF A01 |
| 6682 | 3:21976 | Dep. NTIS, PC A07/MF A01 |
| 6699 | 3:21947 | Dep. NTIS, PC A08/MF A01 |
| 6703 | 3:22506 | Dep. NTIS, PC A15/MF A01 |
| 6768 | 3:22639 | Dep. NTIS, PC A02/MF A01 |
| 6850 | 3:21999 | Dep. NTIS, PC A11/MF A01 |
| 6906 | 3:21883 | Dep. NTIS, PC A06/MF A01 |
| 7000 | 3:21400 | Dep. NTIS, PC A05/MF A01 |
| 7228 | 3:22000 | Dep. NTIS, PC A02/MF A01 |
| **LTR-** | | |
| 1310-17 | 3:21562 | Dep. NTIS, PC A02/MF A01 |
| **M-** | | |
| 078-02 | 3:22132 | Dep. NTIS, PC A02/MF A01 |
| **MBL-** | | |
| 1976-10 | 3:22224 | *See* N-77-26934 |
| **MDC-G-** | | |
| 6776(Vol.3)(Bk.1) | 3:21318 | *See* SAN/1108-8/2 |
| 6776(Vol.3)(Bk.2) | 3:21319 | *See* SAN/1108-8/3 |
| 6776(Vol.4) | 3:21320 | *See* SAN/1108-8/4 |
| 6776(Vol.5) | 3:21321 | *See* SAN/1108-8/5 |
| **MERC/SP-** | | |
| 77/7 | 3:21101 | Dep. NTIS, PC A03/MF A01 |
| **MERC/TPR-** | | |
| 77/3 | 3:21102 | Dep. NTIS, PC A03/MF A01 |
| **MHSMP-** | | |
| 77-57 | 3:22133 | Dep. NTIS, PC A02/MF A01 |
| 77-58 | 3:22134 | Dep. NTIS, PC A02/MF A01 |
| 77-60 | 3:21977 | Dep. NTIS, PC A02/MF A01 |
| **MIT-** | | |
| 2295T9-1 | 3:20859 | Dep. NTIS, PC A07/MF A01 |
| 2295T9-2 | 3:20860 | Dep. NTIS, PC A06/MF A01 |
| **MLM-** | | |
| 2447 | 3:22012 | Dep. NTIS, PC A08/MF A01 |
| 2463 | 3:21172 | Dep. NTIS, PC A02/MF A01 |
| 2497(OP) | 3:20935 | Dep. NTIS, MF A01 |
| **MLR-** | | |
| 640 | 3:22080 | *See* UCRL-13718 |
| **MMM-** | | |
| 2473-0422 | 3:21915 | Dep. NTIS, PC A05/MF A01 |
| **MP-** | | |
| 65 | 3:21110 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| **MR-** | | |
| 168 | 3:21164 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| **MTI-** | | |
| 78TR16 | 3:21103 | Dep. NTIS, PC A02/MF A01 |
| **MTR-** | | |
| 7347(Vol.5) | 3:21309 | Dep. NTIS, PC A13/MF A01 |
| **N-** | | |
| 77-26134 | 3:21854 | NTIS PCA06/MF A01 |
| 77-26135 | 3:21907 | NTIS PCA07/MF A01 |
| 77-26222 | 3:21279 | NTIS PCA02/MF A01 |
| 77-26240 | 3:21985 | NTIS PCA02/MF A01 |
| 77-26271 | 3:21908 | NTIS PCA08/MF A01 |
| 77-26322 | 3:21054 | NTIS PCA02/MF A01 |
| 77-26439 | 3:21760 | NTIS PCA03/MF A01 |
| 77-26478 | 3:22020 | NTIS PCA03/MF A01 |
| 77-26479 | 3:22021 | NTIS PCA03/MF A01 |
| 77-26490 | 3:22022 | NTIS PCA02/MF A01 |
| 77-26550 | 3:21640 | NTIS PCA02/MF A01 |
| 77-26598 | 3:22282 | NTIS PCA06/MF A01 |
| 77-26610 | 3:21369 | NTIS PCA04/MF A01 |
| 77-26611 | 3:21330 | NTIS PCA08/MF A01 |
| 77-26617 | 3:21370 | NTIS PCA02/MF A01 |
| 77-26628 | 3:21473 | NTIS PCA21/MF A01 |
| 77-26630 | 3:21474 | NTIS PCA17/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 77-26631 | 3:21475 | NTIS PCA04/MF A01 |
| 77-26632 | 3:21476 | NTIS PCA05/MF A01 |
| 77-26633 | 3:21477 | NTIS PCA12/MF A01 |
| 77-26634 | 3:21478 | NTIS PCA13/MF A01 |
| 77-26635 | 3:21479 | NTIS PCA05/MF A01 |
| 77-26636 | 3:21480 | NTIS PCA15/MF A01 |
| 77-26934 | 3:22224 | NTIS PCA02/MF A01 |
| 77-26941 | 3:21641 | NTIS PCA03/MF A01 |
| 77-26985 | 3:22448 | |
| 77-27020 | 3:21801 | NTIS PCA06/MF A01 |
| 77-27049 | 3:22295 | NTIS PCA02/MF A01 |
| 77-27050 | 3:22296 | |
| 77-27053 | 3:21917 | NTIS PCA04/MF A01 |
| 77-27056 | 3:22299 | NTIS PCA02/MF A01 |
| 77-27061 | 3:22297 | NTIS PCA03/MF A01 |
| **NASA-CR-** | | |
| 134942-V-3 | 3:21474 | *See* N-77-26630 |
| 134942(Vol.1) | 3:21473 | *See* N-77-26628 |
| 134949-V-1 | 3:21475 | *See* N-77-26631 |
| 134949-V-2-PT-1 | 3:21476 | *See* N-77-26632 |
| 134949-V-2-PT-2 | 3:21477 | *See* N-77-26633 |
| 134949-V-2-PT-3 | 3:21478 | *See* N-77-26634 |
| 134949-V-2-PT-4 | 3:21479 | *See* N-77-26635 |
| 134949-V-3 | 3:21480 | *See* N-77-26636 |
| 135119 | 3:21854 | *See* N-77-26134 |
| 135184 | 3:21907 | *See* N-77-26135 |
| 150300 | 3:21369 | *See* N-77-26610 |
| 150305 | 3:21330 | *See* N-77-26611 |
| 153271 | 3:22020 | *See* N-77-26478 |
| 153292 | 3:22021 | *See* N-77-26479 |
| 154618 | 3:21801 | *See* N-77-27020 |
| **NASA-SP-** | | |
| 418 | 3:21917 | *See* N-77-27053 |
| **NASA-TM-X-** | | |
| 71313 | 3:22296 | *See* N-77-27050 |
| 71335 | 3:22297 | *See* N-77-27061 |
| 71341 | 3:22299 | *See* N-77-27056 |
| 73643 | 3:21279 | *See* N-77-26222 |
| 73677 | 3:21370 | *See* N-77-26617 |
| 74753 | 3:21908 | *See* N-77-26271 |
| **NASA-TT-F-** | | |
| 17302 | 3:21054 | *See* N-77-26322 |
| 17450 | 3:21985 | *See* N-77-26240 |
| **NATO/CCMS-** | | |
| 65 | 3:21448 | *See* LA-7021-C |
| **NBS-BSS-** | | |
| 96 | 3:21267 | National Bureau of Standards, Washington, DC |
| **NBS-TN-** | | |
| 685 | 3:22023 | *See* PB-269777 |
| 946 | 3:21773 | *See* PB-269779 |
| **NBSIR-** | | |
| 76-1117 | 3:21238 | *See* PB-269341 |
| 77-1243 | 3:21705 | *See* PB-269517 |
| 77-1262 | 3:21219 | *See* PB-269346 |
| 77-1274 | 3:21785 | *See* PB-269847 |
| 77-1314 | 3:21331 | Dep. NTIS, PC A06/MF A01 |
| **NCRP-** | | |
| 51 | 3:22097 | National Council on Radiation Protection Measurements, Washington, DC |
| **NEDO-** | | |
| 20913A | 3:21557 | General Electric Co., San Jose, CA |
| **NIIAR-P-** | | |
| 250 | 3:21902 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| **NP-** | | |
| 22124 | 3:21395 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| 22159/2 | 3:21310 | Dep. NTIS (US Sales Only), PC A11/MF A01 |
| 22319 | 3:21404 | Dep. NTIS (US Sales Only), PC A02/MF A01 |
| 22447 | 3:21332 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| 22636 | 3:21411 | Ottawa; Information Canada (1975). $2.40 |
| 22761 | 3:21712 | Salt Lake City; State Energy Office (1977). |
| 22764 | 3:21697 | Washington, DC; Department of the Interior (1976). |
| 22768 | 3:21486 | Dep. NTIS (US Sales Only), PC A05/MF A01 |
| 22771 | 3:21868 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| 22802 | 3:20936 | National Academy of Sciences, Washington, DC |
| 22816 | 3:21242 | TIC |
| 22827 | 3:21710 | *See* tle; Seattle City Light (Sep 1977). |
| **NSF/RANN/SE/AER-** | | |
| 72-03597/A03/74/4 | 3:21316 | Boston Univ. |
| **NSF/RANN/SE/GI-** | | |
| 43093/PR/75/2 | 3:21280 | *See* PB-269587 |
| **NTIS/PS-** | | |
| 76/0464 | 3:21390 | Springfield, VA; National Technical Information Service (1976). |
| **NUREG-** | | |
| 0095 | 3:21218 | *See* ERDA-77-34 |
| 0264-4 | 3:21642 | NTIS, $5.25 |
| 0384 | 3:21623 | NTIS, $6.00 |
| 0410 | 3:21594 | NTIS, $14.50 |
| **NYO-** | | |
| 3425-14 | 3:22191 | Dep. NTIS, PC A05/MF A01 |
| **ORC-** | | |
| 77-25 | 3:21222 | *See* UCRL-13733-5 |
| **ORNL-** | | |
| 5302 | 3:22682 | Dep. NTIS, PC A03/MF A01 |
| **ORNL/EIS-** | | |
| 122 | 3:21531 | Dep. NTIS, PC A09/MF A01 |
| **ORNL/NUREG/TM-** | | |
| 124 | 3:21643 | Dep. NTIS, PC A04/MF A01 |
| **ORNL/Sub-** | | |
| 4415 | 3:21181 | Dep. NTIS, MF A01 |
| **ORNL/TM-** | | |
| 5866 | 3:21152 | Dep. NTIS, PC A03/MF A01 |
| 5908 | 3:21241 | Dep. NTIS, PC A03/MF A01 |
| 5920 | 3:21587 | Dep. NTIS, PC A03/MF A01 |
| 5967 | 3:22476 | Dep. NTIS, PC A03/MF A01 |
| 6079 | 3:22603 | Dep. NTIS, PC A04/MF A01 |
| 6092 | 3:21153 | AT |
| 6103 | 3:22455 | Dep. NTIS, PC A03/MF A01 |
| 6108 | 3:22386 | Dep. NTIS, PC A03/MF A01 |
| 6136 | 3:21144 | Dep. NTIS, PC A05/MF A01 |
| 6148 | 3:22579 | Dep. NTIS, PC A03/MF A01 |
| **ORNL-tr-** | | |
| 4410 | 3:22488 | Dep. NTIS, PC A03/MF A01 |
| 4518 | 3:22203 | Dep. NTIS, PC A02/MF A01 |
| 4519 | 3:21481 | Dep. NTIS, PC A03/MF A01 |
| 4526 | 3:22267 | Dep. NTIS, PC A02/MF A01 |
| 4529 | 3:22121 | Dep. NTIS, PC A02/MF A01 |
| 4530 | 3:22555 | Dep. NTIS, PC A03/MF A01 |
| 4531 | 3:22576 | Dep. NTIS, PC A03/MF A01 |
| 4534 | 3:22066 | Dep. NTIS, PC A02/MF A01 |
| 4537 | 3:22415 | Dep. NTIS, PC A02/MF A01 |
| 4547 | 3:22260 | Dep. NTIS, PC A02/MF A01 |
| 4551 | 3:22279 | Dep. NTIS, PC A02/MF A01 |
| **ORO-** | | |
| 1797-76 | 3:21948 | Dep. NTIS, PC A02/MF A01 |
| 2504-267 | 3:22119 | Dep. NTIS, PC A04/MF A01 |
| 3018-180 | 3:21978 | Dep. NTIS, PC A10/MF A01 |
| 5301-18 | 3:20954 | Dep. NTIS, PC A07/MF A01 |
| 5302-16 | 3:20955 | Dep. NTIS, PC A04/MF A01 |
| 5303-15 | 3:20956 | Dep. NTIS, PC A03/MF A01 |
| 5594-9 | 3:22604 | Dep. NTIS, PC A02/MF A01 |
| **ORO/5217-** | | |
| 1 | 3:21672 | Dep. NTIS, PC A04/MF A01 |
| **OUEL-** | | |
| 1159/76 | 3:21641 | *See* N-77-26941 |
| 1168/76 | 3:21640 | *See* N-77-26550 |
| **PATENTS-DE-** | | (German: Deutsches Patentamt, Dienstatelle Berlin, Gitschiner Str. 97-103, 1000 Berlin 61, F.R. Germany, DM 3.- per copy, plus postage) |
| 604,109/A/ | 3:21176 | |
| 1,667,851/B/ | 3:21148 | |
| 2,451,438/A/ | 3:21177 | |
| 2,453,243/C/ | 3:21778 | |
| 2,453,616/A/ | 3:21851 | |
| 2,502,595/A/ | 3:21368 | |
| 2,520,870/A/ | 3:21161 | |
| 2,527,662/A/ | 3:21467 | |
| 2,531,958/A/ | 3:21138 | |
| 2,533,759/A/ | 3:21780 | |
| 2,545,098/A/ | 3:21769 | |
| 2,545,498/A/ | 3:21675 | |
| 2,555,815/A/ | 3:20909 | |
| 2,557,560/A/ | 3:20908 | |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 2,600,034/A/ | 3:20907 | |
| 2,607,968/A/ | 3:20897 | |
| 2,613,122/A/ | 3:20884 | |
| 2,613,417/A/ | 3:20906 | |
| 2,629,028/A/ | 3:21673 | |
| PATENTS-US- | (US: Commissioner of Patents, Washington, D.C. 20231, USA, $.50 per copy. Government Patent Applications available from NTIS) | |
| A 745,942 | 3:21762 | |
| 4,003,007 | 3:22606 | |
| 4,004,175 | 3:22102 | |
| 4,011,149 | 3:21315 | |
| 4,021,323 | 3:21314 | |
| 4,040,266 | 3:20987 | |
| 4,040,866 | 3:21006 | |
| 4,040,943 | 3:20997 | |
| 4,042,490 | 3:20986 | |
| 4,042,669 | 3:22094 | |
| 4,043,755 | 3:21933 | |
| 4,046,521 | 3:20996 | |
| 4,053,015 | 3:20960 | |
| 4,054,421 | 3:20847 | |
| 4,054,422 | 3:21982 | |
| 4,056,112 | 3:21213 | |
| 4,056,934 | 3:21865 | |
| 4,057,401 | 3:21260 | |
| 4,057,736 | 3:21532 | |
| 4,057,944 | 3:21774 | |
| 4,057,945 | 3:21775 | |
| 4,059,061 | 3:21842 | |
| 4,059,077 | 3:21861 | |
| 4,059,078 | 3:21862 | |
| 4,059,082 | 3:21863 | |
| 4,059,386 | 3:22085 | |
| 4,059,666 | 3:21005 | |
| 4,059,670 | 3:21142 | |
| 4,059,671 | 3:21154 | |
| 4,059,769 | 3:21239 | |
| 4,059,772 | 3:21517 | |
| 4,067,958 | 3:21244 | |
| 4,069,120 | 3:21245 | |
| 4,069,137 | 3:20984 | |
| PB- | | |
| 268850 | 3:21715 | |
| 269254 | 3:21266 | NTIS PCA02/MF A01 |
| 269341 | 3:21238 | NTIS PCA02/MF A01 |
| 269346 | 3:21219 | NTIS PCA03/MF A01 |
| 269348 | 3:21741 | NTIS PCA03/MF A01 |
| 269365 | 3:21813 | NTIS PCA07/MF A01 |
| 269366 | 3:21814 | NTIS PCA05/MF A01 |
| 269367 | 3:21815 | |
| 269420 | 3:21848 | NTIS PCA06/MF A01 |
| 269451 | 3:21691 | NTIS PCA10/MF A01 |
| 269497 | 3:21683 | NTIS PCA04/MF A01 |
| 269517 | 3:21705 | NTIS PCA09/MF A01 |
| 269528 | 3:21736 | NTIS PCA03/MF A01 |
| 269556 | 3:20929 | NTIS PCA07/MF A01 |
| 269557 | 3:20861 | NTIS PCA11/MF A01 |
| 269559 | 3:22145 | NTIS PCA06/MF A01 |
| 269567 | 3:22146 | NTIS PCA16/MF A01 |
| 269568 | 3:20913 | NTIS PCA21/MF A01 |
| 269587 | 3:21280 | NTIS PCA02/MF A01 |
| 269614 | 3:21748 | NTIS PCA03/MF A01 |
| 269652 | 3:22212 | NTIS PCA03/MF A01 |
| 269670 | 3:21281 | NTIS PCA05/MF A01 |
| 269671 | 3:21282 | |
| 269684 | 3:21849 | NTIS PCA10/MF A01 |
| 269723 | 3:21628 | NTIS PCA22/MF A01 |
| 269724 | 3:21629 | NTIS PCA11/MF A01 |
| 269725 | 3:21630 | NTIS PCA17/MF A01 |
| 269726 | 3:21631 | |
| 269727 | 3:21632 | NTIS PCA07/MF A01 |
| 269745 | 3:21701 | NTIS PCA03/MF A01 |
| 269746 | 3:21803 | NTIS PCA04/MF A01 |
| 269748 | 3:21688 | NTIS PCA04/MF A01 |
| 269777 | 3:22023 | NTIS PCA03/MF A01 |
| 269779 | 3:21773 | NTIS PCA05/MF A01 |
| 269803 | 3:21692 | NTIS PCA03/MF A01 |
| 269807 | 3:21728 | NTIS PCA12/MF A01 |
| 269819 | 3:21817 | NTIS PCA07/MF A01 |
| 269820 | 3:21818 | NTIS PCA05/MF A01 |
| 269821 | 3:21819 | NTIS PCA04/MF A01 |
| 269830 | 3:21820 | NTIS PCA09/MF A01 |
| 269831 | 3:21821 | NTIS PCA08/MF A01 |
| 269832 | 3:21822 | NTIS PCA13/MF A01 |
| 269847 | 3:21785 | NTIS PCA08/MF A01 |
| 269850 | 3:21525 | NTIS PCA04/MF A01 |
| 269858 | 3:21988 | NTIS PCA04/MF A01 |
| 269865 | 3:21729 | NTIS PCA04/MF A01 |
| 269869 | 3:21823 | NTIS PCA11/MF A01 |
| 269870 | 3:21824 | NTIS PCA13/MF A01 |
| 269871 | 3:21825 | |
| 269872 | 3:21826 | NTIS PCA08/MF A01 |
| 269873 | 3:21827 | NTIS PCA04/MF A01 |
| 269874 | 3:21828 | NTIS PCA03/MF A01 |
| 269875 | 3:21689 | NTIS PCA05/MF A01 |
| 269877 | 3:22147 | NTIS PCA10/MF A01 |
| 269887 | 3:21829 | NTIS PCA12/MF A01 |
| 269888 | 3:21830 | NTIS PCA99/MF A01 |
| 269889 | 3:21831 | NTIS PCA07/MF A01 |
| 269902 | 3:22213 | NTIS PCA02/MF A01 |
| 269906 | 3:21797 | NTIS PCA05/MF A01 |
| 269914 | 3:20917 | NTIS PCA02/MF A01 |
| 269951 | 3:20958 | NTIS PCA05/MF A01 |
| 270025 | 3:21804 | NTIS PCA04/MF A01 |
| 270068 | 3:21798 | NTIS PCA19/MF A01 |
| 270069 | 3:21799 | NTIS PCA12/MF A01 |
| 270070 | 3:21800 | NTIS PCA07/MF A01 |
| 270085 | 3:21841 | NTIS PCA07/MF A01 |
| 270088 | 3:21730 | NTIS PCA07/MF A01 |
| 270112 | 3:22092 | NTIS PCA99/MF A01 |
| 270151 | 3:21731 | NTIS PCA07/MF A01 |
| 270152 | 3:21732 | NTIS PCA04/MF A01 |
| 270153 | 3:21733 | NTIS PCA14/MF A01 |
| 270418 | 3:21019 | NTIS PCA15/MF A01 |
| 270423 | 3:22225 | NTIS PCA23/MF A01 |
| 270463 | 3:21595 | |
| 270656 | 3:21220 | NTIS PCA02/MF A01 |
| 271104 | 3:21684 | NTIS PCA23/MF A01 |
| PERC/RI-77/13 | 3:20904 | Dep. NTIS, PC A03/MF A01 |
| PNL- | | |
| 2383 | 3:22207 | Dep. NTIS, PC A03/MF A01 |
| 2433 | 3:22141 | Dep. NTIS, PC A20/MF A01 |
| 2436 | 3:21459 | Dep. NTIS, PC A04/MF A01 |
| 2442 | 3:21460 | Dep. NTIS, PC A03/MF A01 |
| PPPL- | | |
| 1394 | 3:22420 | Dep. NTIS, PC A02/MF A01 |
| 1397 | 3:22477 | Dep. NTIS, PC A04/MF A01 |
| 1399 | 3:22683 | Dep. NTIS, PC A04/MF A01 |
| 1400 | 3:22478 | Dep. NTIS, PC A02/MF A01 |
| 1401 | 3:22456 | Dep. NTIS, PC A03/MF A01 |
| 1403 | 3:22449 | Dep. NTIS, PC A03/MF A01 |
| 1404 | 3:22457 | Dep. NTIS, PC A03/MF A01 |
| PRS-19 | 3:21525 | *See* PB-269850 |
| PUB-113(Vol.3) | 3:22403 | Dep. NTIS, PC A15/MF A01 |
| REPT- | | |
| 76-9E9-ECAS-R2(Vol.1) | 3:21473 | *See* N-77-26628 |
| 76-9E9-ECAS-R2-V-3 | 3:21474 | *See* N-77-26630 |
| 77SR-VA-U3 | 3:22020 | *See* N-77-26478 |
| RFP- | | |
| 2433 | 3:22010 | Dep. NTIS, PC A02/MF A01 |
| 2434 | 3:22281 | Dep. NTIS, PC A02/MF A01 |
| 2458 | 3:21166 | Dep. NTIS, PC A02/MF A01 |
| RH-76-7 | 3:22017 | *See* AD-A-042504 |
| RLO- | | |
| 2232-T1-4 | 3:22358 | Dep. NTIS, PC A02/MF A01 |
| RLO/2225/T3-6 | 3:22379 | Dep. NTIS, PC A02/MF A01 |
| RLO/2225/T5-35 | 3:22239 | Dep. NTIS, PC A03/MF A01 |
| RLO/2228/T003-2 | 3:20914 | Dep. NTIS, PC A02/MF A01 |
| RLO/2229/T1- | | |
| 40 | 3:22286 | Dep. NTIS, PC A03/MF A01 |
| 41 | 3:22214 | Dep. NTIS, PC A03/MF A01 |
| SAN- | | |
| 115P108-1(Vol.1) | 3:21428 | Dep. NTIS, PC A07/MF A01 |
| 115P108-1(Vol.2) | 3:21427 | Dep. NTIS, PC A07/MF A01 |
| 235P13-39(Vol.1) | 3:21327 | Dep. NTIS, PC A08/MF A01 |
| 1261/1 | 3:21258 | Dep. NTIS, PC A04/MF A01 |
| SAN/1108- | | |
| 8/2 | 3:21318 | Dep. NTIS, PC A16/MF A01 |
| 8/3 | 3:21319 | Dep. NTIS, PC A20/MF A01 |
| 8/4 | 3:21320 | Dep. NTIS, PC A17/MF A01 |
| 8/5 | 3:21321 | Dep. NTIS, PC A23/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| SAN/1132-2/4 | 3:21325 | Dep. NTIS, PC A07/MF A01 |
| SAN/1164-1 | 3:21858 | Dep. NTIS, PC A04/MF A01 |
| SAN/1220-1 | 3:21360 | Dep. NTIS, PC A12/MF A01 |
| SAN/1317-3 | 3:21450 | Dep. NTIS, PC A09/MF A01 |
| SAN/1396-12 | 3:20959 | Dep. NTIS, PC A02/MF A01 |
| SAND-76-0614 | 3:21644 | Dep. NTIS, PC A03/MF A01 |
| 77-0043 | 3:21221 | NTIS, MF A01 |
| 77-0646 | 3:22001 | Dep. NTIS, PC A03/MF A01 |
| 77-0874 | 3:21268 | Dep. NTIS, PC A03/MF A01 |
| 77-1023 | 3:22692 | Dep. NTIS, PC A03/MF A01 |
| 77-1116C | 3:21625 | Dep. NTIS, PC A02/MF A01 |
| 77-1148 | 3:22385 | Dep. NTIS, PC A05/MF A01 |
| 77-1411 | 3:21240 | Dep. NTIS, PC A04/MF A01 |
| 77-1412C | 3:21271 | Dep. NTIS, PC A03/MF A01 |
| 77-1436C | 3:22002 | Dep. NTIS, PC A02/MF A01 |
| 77-1495C | 3:22640 | Dep. NTIS, PC A02/MF A01 |
| 77-1592C | 3:22641 | Dep. NTIS, PC A02/MF A01 |
| 77-1599 | 3:22079 | Dep. NTIS, PC A02/MF A01 |
| 77-1821 | 3:20862 | Dep. NTIS, PC A03/MF A01 |
| 77-1829C | 3:22421 | Dep. NTIS, PC A02/MF A01 |
| 77-1914C | 3:22129 | NTIS, MF A01 |
| 77-6024 | 3:21900 | Dep. NTIS, PC A02/MF A01 |
| 77-7024 | 3:21167 | NTIS, MF A01 |
| 77-8040 | 3:22140 | Dep. NTIS, PC A03/MF A01 |
| 77-8264 | 3:21384 | Dep. NTIS, PC A03/MF A01 |
| 78-0030C | 3:21859 | Dep. NTIS, PC A02/MF A01 |
| SHS-IFSY-RU-3 | 3:21259 | Dep. NTIS (US Sales Only), PC A03/MF A01 |
| SIND-PM-1977-3 | 3:21742 | Dep. NTIS (US Sales Only), PC A09/MF A01 |
| SLAC-PUB-1601 | 3:22380 | Dep. NTIS, PC A02/MF A01 |
| 1602 | 3:22339 | Dep. NTIS, PC A02/MF A01 |
| 2010 | 3:22381 | Dep. NTIS, PC A03/MF A01 |
| 2051 | 3:22347 | Dep. NTIS, PC A02/MF A01 |
| SNV-PM-794 | 3:22148 | Dep. NTIS (US Sales Only), PC A06/MF A01 |
| SRD-76-064-1-V-1 | 3:21475 | *See* N-77-26631 |
| 76-064-2-V-2-PT-1 | 3:21476 | *See* N-77-26632 |
| 76-064-2-V-2-PT-4 | 3:21479 | *See* N-77-26635 |
| 76-064-2-V-2-PT-3 | 3:21478 | *See* N-77-26634 |
| 76-064-2-V-2-PT-2 | 3:21477 | *See* N-77-26633 |
| 76-064-3 | 3:21480 | *See* N-77-26636 |
| SRO-946-1 | 3:22348 | Dep. NTIS, PC A02/MF A01 |
| SSS-R-77-3205 | 3:20854 | *See* FE-1770-26 |
| STU-75-5234 | 3:22015 | Dep. NTIS (US Sales Only), PC A04/MF A01 |
| SU-326-P.39-26 | 3:22693 | Dep. NTIS, PC A02/MF A01 |
| TDCK-68321 | 3:22224 | *See* N-77-26934 |
| TH-76-E-66 | 3:21760 | *See* N-77-26439 |
| TID-3365 | 3:21413 | Dep. NTIS, PC A06/MF A01 |
| 22790 | 3:22215 | Dep. NTIS, PC A03/MF A01 |
| 27152 | 3:21755 | Dep. NTIS, PC A15/MF A01 |
| 27646 | 3:22324 | Dep. NTIS, PC A10/MF A01 |
| 27702 | 3:21311 | Dep. NTIS, PC A10/MF A01 |
| 27816 | 3:21588 | Dep. NTIS, PC A05/MF A01 |
| 27836 | 3:22149 | Dep. NTIS, PC A06/MF A01 |
| 27895 | 3:21589 | AT |
| 27939 | 3:21482 | Dep. NTIS, PC A03/MF A01 |
| 27970 | 3:21104 | Dep. NTIS, PC A02/MF A01 |
| 28010 | 3:21449 | Dep. NTIS, PC A02/MF A01 |
| 28025 | 3:21738 | NTIS, MF A01 |
| 28047 | 3:21709 | Dep. NTIS, MF A01 |
| 28064 | 3:21743 | Dep. NTIS, PC A08/MF A01 |
| 28066 | 3:21727 | Dep. NTIS, PC A03/MF A01 |
| 28068 | 3:21263 | Dep. NTIS, PC A02/MF A01 |
| 28070 | 3:21685 | Dep. NTIS, PC A13/MF A01 |
| 28102 | 3:21035 | Dep. NTIS, PC A11/MF A01 |
| TM-77-5 | 3:21369 | *See* N-77-26610 |
| TREE-1115 | 3:22361 | Dep. NTIS, PC A03/MF A01 |
| TREE-NUREG-1124 | 3:21645 | Dep. NTIS, PC A16/MF A01 |
| 1137 | 3:21646 | NTIS, MN A01 |
| 1151 | 3:21647 | Dep. NTIS, PC A13/MF A01 |
| 1177 | 3:21563 | Dep. NTIS, PC A03/MF A01 |
| 1188 | 3:21648 | Dep. NTIS, PC A06/MF A01 |
| TRG-Report-2953(S) | 3:21884 | Dep. NTIS (US Sales Only), PC A05/MF A01 |
| TSR-77/2 | 3:20852 | *See* DOE/JPL/2616-2 |
| TVA-E-EP-77-3 | 3:22212 | *See* PB-269652 |
| UCID-15644-77-3 | 3:21918 | Dep. NTIS, PC A03/MF A01 |
| 17535 | 3:21313 | Dep. NTIS, PC A02/MF A01 |
| 17555 | 3:22642 | Dep. NTIS, PC A03/MF A01 |
| 17590 | 3:21248 | Dep. NTIS, PC A02/MF A01 |
| 17613 | 3:22688 | Dep. NTIS, PC A03/MF A01 |
| 17629 | 3:22024 | Dep. NTIS, PC A04/MF A01 |
| 17632 | 3:21433 | Dep. NTIS, PC A02/MF A01 |
| 17650 | 3:22422 | Dep. NTIS, PC A04/MF A01 |
| 17661 | 3:21649 | Dep. NTIS, PC A03/MF A01 |
| 17662 | 3:21650 | Dep. NTIS, PC A02/MF A01 |
| 17665 | 3:21894 | Dep. NTIS, PC A02/MF A01 |
| 17666 | 3:21895 | Dep. NTIS, PC A02/MF A01 |
| 17669 | 3:22390 | Dep. NTIS, PC A02/MF A01 |
| 17677 | 3:21458 | NTIS, MF A01 |
| 17680 | 3:22323 | Dep. NTIS, PC A03/MF A01 |
| 17682 | 3:21108 | Dep. NTIS, PC A02/MF A01 |
| 17691 | 3:22596 | Dep. NTIS, PC A02/MF A01 |
| UCRL-13718 | 3:22080 | Dep. NTIS, PC A03/MF A01 |
| 13733-5 | 3:21222 | Dep. NTIS, PC A03/MF A01 |
| 13762 | 3:22025 | Dep. NTIS, PC A02/MF A01 |
| 13782 | 3:22249 | Dep. NTIS, PC A02/MF A01 |
| 13804 | 3:21182 | Dep. NTIS, PC A07/MF A01 |
| 51879(Pt.3) | 3:22201 | Dep. NTIS, PC A04/MF E01 |
| 52242 | 3:22694 | Dep. NTIS, PC A03/MF A01 |
| 52256(Pt.2) | 3:21105 | Dep. NTIS, PC A03/MF A01 |
| 52339 | 3:22423 | Dep. NTIS, PC A02/MF A01 |
| 52346 | 3:21857 | Dep. NTIS, PC A02/MF A01 |
| 79442 | 3:21236 | Dep. NTIS, PC A02/MF A01 |
| 79535 | 3:22643 | Dep. NTIS, PC A02/MF A01 |
| 79653 | 3:22539 | Dep. NTIS, PC A03/MF A01 |
| 79736 | 3:22644 | Dep. NTIS, PC A02/MF A01 |
| 79770 | 3:22068 | Dep. NTIS, PC A02/MF A01 |
| 79772 | 3:21237 | Dep. NTIS, PC A03/MF A01 |
| 79776 | 3:22645 | Dep. NTIS, PC A02/MF A01 |
| 79779 | 3:22646 | Dep. NTIS, PC A02/MF A01 |
| 79780 | 3:22424 | Dep. NTIS, PC A02/MF A01 |
| 79782 | 3:22425 | Dep. NTIS, PC A02/MF A01 |
| 79784 | 3:22647 | Dep. NTIS, PC A02/MF A01 |
| 79787 | 3:22648 | Dep. NTIS, PC A02/MF A01 |
| 79801 | 3:22649 | Dep. NTIS, PC A02/MF A01 |
| 79870 | 3:22540 | Dep. NTIS, PC A02/MF A01 |
| 80075 | 3:22541 | Dep. NTIS, PC A02/MF A01 |
| 80076 | 3:22542 | Dep. NTIS, PC A02/MF A01 |
| 80104 | 3:22650 | Dep. NTIS, PC A02/MF A01 |
| 80169 | 3:22651 | Dep. NTIS, PC A02/MF A01 |
| 80171 | 3:22697 | Dep. NTIS, PC A03/MF A01 |
| 80249 | 3:22652 | Dep. NTIS, PC A02/MF A01 |
| 80314 | 3:22653 | Dep. NTIS, PC A02/MF A01 |
| 80322(Summ.) | 3:22654 | Dep. NTIS, PC A02/MF A01 |
| 80384 | 3:22620 | Dep. NTIS, PC A02/MF A01 |
| 80406 | 3:22621 | Dep. NTIS, PC A03/MF A01 |
| 80408 | 3:22622 | NTIS, MF A01 |
| 80418 | 3:22623 | Dep. NTIS, PC A02/MF A01 |
| 80419 | 3:22026 | Dep. NTIS, PC A03/MF A01 |
| 80424 | 3:22608 | Dep. NTIS, PC A03/MF A01 |
| 80475 | 3:22543 | Dep. NTIS, PC A02/MF A01 |
| UCRL-Trans-1541 | 3:22105 | Dep. NTIS, PC A05/MF A01 |
| 1542 | 3:22100 | Dep. NTIS, MF A01 |
| 11290 | 3:22601 | Dep. NTIS, PC A02/MF A01 |
| 11291 | 3:22393 | Dep. NTIS, PC A02/MF A01 |
| 11297 | 3:22631 | Dep. NTIS, PC A04/MF A01 |
| 11298 | 3:22431 | Dep. NTIS, PC A02/MF A01 |
| 11303 | 3:22696 | Dep. NTIS, PC A03/MF A01 |
| 11307 | 3:22451 | Dep. NTIS, PC A02/MF A01 |
| 11308 | 3:22655 | Dep. NTIS, PC A02/MF A01 |
| UILU-ENG-77-1752 | 3:22690 | *See* COO-2383-45 |
| UMD-4908-10 | 3:21333 | Dep. NTIS, PC A02/MF A01 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| USGS-OFR- | | |
| 77-761 | 3:21183 | Dep. NTIS, PC A03/MF A01 |
| VPI-E- | | |
| 77-18 | 3:21908 | *See* N-77-26271 |
| VU-PL- | | |
| 7/77 | 3:22021 | *See* N-77-26479 |
| WARD- | | |
| 353 | 3:21590 | AT |
| WFPS-TME- | | |
| 059 | 3:22597 | Dep. NTIS, PC A02/MF A01 |
| 060 | 3:22580 | Dep. NTIS, PC A03/MF A01 |
| 062 | 3:22544 | Dep. NTIS, PC A02/MF A01 |
| 064 | 3:22605 | Dep. NTIS, PC A02/MF A01 |
| 068 | 3:22630 | Dep. NTIS, PC A02/MF A01 |
| X- | | |
| 660-77-144 | 3:22297 | *See* N-77-27061 |
| 661-77-104 | 3:22296 | *See* N-77-27050 |
| 682-77-136 | 3:22299 | *See* N-77-27056 |
| Y- | | |
| 2107 | 3:21986 | Dep. NTIS, PC A02/MF A01 |
| Y/OWI/SUB- | | |
| 77/16523/2 | 3:21184 | Dep. NTIS, PC A04/MF A01 |
| 77/16535/2 | 3:21185 | Dep. NTIS, PC A03/MF A01 |
| 77/16535/4 | 3:21186 | Dep. NTIS, PC A03/MF A01 |
| 77/16535/7 | 3:21187 | Dep. NTIS, PC A02/MF A01 |
| 77/16535/8 | 3:21188 | Dep. NTIS, PC A03/MF A01 |
| 77/16537 | 3:21189 | Dep. NTIS, PC A03/MF A01 |
| 77-22324(Vol.2)(App.) | 3:22016 | NTIS, MF A01 |
| 77/42509 | 3:21211 | Dep. NTIS, PC A07/MF A01 |
| 4091/6 | 3:21190 | Dep. NTIS, PC A06/MF A01 |
| 4310/4 | 3:21191 | Dep. NTIS, PC A03/MF A01 |
| ZJE- | | |
| 186 | 3:21874 | Dep. NTIS (US Sales Only), PC A03/MF A01 |

## Abbreviations Used in Availability Column

**AT** Liquid Metal Fast Breeder Reactor applied technology is available to domestic requesters within the United States from the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.
Information regarding subscription purchase will be sent on request.
Foreign requesters should address inquiries to the above address.

**Dep.** DOE reports so designated are maintained in the organizations listed on the inside front cover.

**EM** Inquiries regarding the availability of blueline prints of DOE engineering drawings which were formerly available for sale by NTIS should be addressed to Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

**GJO** Available from DOE Grand Junction Office, P. O. Box 2567, Grand Junction, Colorado 81501.

**GPO** For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.

**LMEC** Available *only to requesters within the United States* from the Liquid Metal Engineering Center, P. O. Box 1449, Canoga Park, California 91304.

**NTIS** For sale by the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161. Price given is the domestic price for paper copy; foreign purchasers add $2.50 per report copy. Some recent NTIS availability statements will include pricing codes as opposed to prices. These codes are related to actual prices in the table below.

**RSO** Available *only to requesters within the United States* from the Reactor Standards Office, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tennessee 37830.

**TIC** Available from the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

## NTIS NORTH AMERICAN PRICE CODES

**Issue 4**

**October 1977**

**Most NTIS products and services are now announced by price codes and, therefore, without specific prices in NTIS journals, newsletters and indexes.**

**The current dollar equivalent for each code is shown in the schedule below. Orders must list the accession number(s) and be accompanied by the total dollar amount from the current schedule.**

**ISSUE 4 prices will be valid through March 31, 1978. After that date, source clients who have not received the latest schedule may contact the Input Branch, 703-557-4690 for the next issue.**

### NORTH AMERICAN CONTINENT PRICE SCHEDULE

**Customers in Canada, U.S., and Mexico please use this price schedule; other addressees write for Folder PR-360-4.**

| | | | | | |
|---|---|---|---|---|---|
| A01 | $3.00 | E01 | $3.25 | T01 | $110.00 |
| A02 | 4.00 | E02 | 4.75 | T02 | 125.00 |
| A03 | 4.50 | E03 | 6.25 | T03 | 175.00 |
| A04 | 5.25 | E04 | 7.50 | T04 | 250.00 |
| A05 | 6.00 | E05 | 9.00 | T05 | 300.00 |
| A06 | 6.50 | E06 | 10.50 | T06 | 350.00 |
| A07 | 7.25 | E07 | 12.50 | T07 | 400.00 |
| A08 | 8.00 | E08 | 15.00 | T08 | 450.00 |
| A09 | 9.00 | E09 | 17.50 | T09 | 500.00 |
| A10 | 9.25 | E10 | 20.00 | T10 | 550.00 |
| A11 | 9.50 | E11 | 22.50 | T11 | 600.00 |
| A12 | 10.75 | E12 | 25.00 | T12 | 650.00 |
| A13 | 11.00 | E13 | 28.00 | T13 | 675.00 |
| A14 | 11.75 | E14 | 31.00 | T14 | 750.00 |
| A15 | 12.00 | E15 | 34.00 | T15 | 800.00 |
| A16 | 12.50 | E16 | 37.00 | T16 | 850.00 |
| A17 | 13.00 | E17 | 40.00 | T17 | 900.00 |
| A18 | 13.25 | E18 | 45.00 | T18 | 950.00 |
| A19 | 14.00 | E19 | 50.00 | T19 | 1,000.00 |
| A20 | 14.50 | E20 | 60.00 | T99 | * |
| A21 | 15.00 | E99 | * | | |
| A22 | 15.25 | | | | |
| A23 | 15.50 | N01 | 28.00 | | |
| A24 | 16.25 | N02 | 50.00 | | |
| A25 | 16.50 | | | | |
| A99 | * | | | | |

*Contact NTIS for price quote

**PRICES EFFECTIVE OCT. 1, 1977 THRU MAR. 31, 1978**

**U.S. DEPARTMENT OF COMMERCE**
**National Technical Information Service**
5285 Port Royal Road
Springfield, Virginia 22161

Cut out appropriate form and mail in a stamped envelope to the address indicated.

## *Change of Address Form*

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

Mail this form to:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here.

## *Subscription Order Form*

**SUBSCRIPTION ORDER FORM**

**ENTER MY SUBSCRIPTION TO:**

**@ $ Domestic; @ $ Foreign.**

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No. .....

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

# COMPLETE OR PARTIAL COLLECTIONS OF DOE REPORTS IN COUNTRIES OTHER THAN THE UNITED STATES

**ARGENTINA**
Buenos Aires, Comisión Nacional de Energía Atómica

**AUSTRALIA**
Canberra, National Library of Australia
Sutherland, New South Wales Atomic Energy Research Establishment

**AUSTRIA**
Vienna, International Atomic Energy Agency (IAEA)
Vienna, Zentralbibliothek der Physikalischen Institute der Universität

**BELGIUM**
Brussels, European Atomic Energy Community (Euratom)
Mol-Donk, Centre d'Etude de l'Energie Nucléaire

**BRAZIL**
Rio de Janeiro, Comissão Nacional de Energia Nuclear
São Paulo, Instituto de Energia Atómica

**CANADA**
Chalk River, Ontario, Atomic Energy of Canada, Ltd.
Hamilton, Ontario, McMaster University
Ottawa, National Research Council

**CONGO, REPUBLIC OF**
Kinshasa, Trico Nuclear Center

**DENMARK**
Risö, Danish Atomic Energy Commission

**FINLAND**
Otaniemi, Teknillinen Korkeakoulu

**FRANCE**
Saclay, Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay

**GERMANY, WEST**
Karlsruhe, Zentralstelle für Atomkernenergie Dokumentation
Munich, Technische Universität

**GREECE**
Athens, Nuclear Research Center, Democritus Library

**INDIA**
Bombay, Trombay, Bhabha Atomic Research Center Library

**IRAQ, REPUBLIC OF**
Baghdad, Atomic Energy Commission, Nuclear Research Institute

**IRELAND**
Dublin, University College

**ISRAEL**
Yavne, Israel Atomic Energy Commission, Soreq Nuclear Research Centre

**ITALY**
Ispra, Cetis Library
Rome, Centro di Studi Nucleari della Casaccia

**JAPAN**
Tokyo, National Diet Library
Tokai-Mura, Naka-gun, Ibaraki-ken, Japan Atomic Energy Research Institute

**KOREA, REPUBLIC OF**
Seoul, Atomic Energy Research Institute

**MEXICO**
Mexico, D. F., Comisión Nacional de Energía Nuclear

**NETHERLANDS, THE**
Petten, Reactor Centrum Nederland
The Hague, Bibliothek Octrooiraad

**NORWAY**
Kjeller, Institutt for Atomenergi

**PORTUGAL**
Sacavem, Junta de Energia Nuclear

**SOUTH AFRICA, REPUBLIC OF**
Pretoria, Atomic Energy Board Library

**SPAIN**
Madrid, Junta de Energía Nuclear, Ciudad Universitaria

**SWEDEN**
Nyköping, Aktiebolaget Atomenergi Library

**SWITZERLAND**
Zürich, Swiss Federal Institute of Technology

**UNITED KINGDOM**
Boston Spa, Wetherby, Yorkshire, British Library Lending Division
Harwell, Didcot, Berkshire, Atomic Energy Research Establishment

# IN INTERNATIONAL AGENCIES

**EUROPEAN ATOMIC ENERGY COMMUNITY (EURATOM)**
Brussels, Belgium
Ispra, Varese, Italy, Cetis Library

**OECD NUCLEAR ENERGY AGENCY (NEA)**
British Library Lending Division
Boston Spa, Wetherby, Yorkshire, England

**INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)**
Vienna, Austria

UNITED STATES ENERGY RESEARCH
AND DEVELOPMENT ADMINISTRATION
P. O. BOX 62
OAK RIDGE, TENNESSEE 37830

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
U. S. ENERGY RESEARCH
AND DEVELOPMENT ADMINISTRATION

U.S.MAIL

FS- 1

XEROX UNIVERSITY MICROFILMS
SERIALS DEPT
300 N ZEEB ROAD
ANN ARBOR, MI 48106